ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CONGESTIVE HEART FAILURE

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ABBREVIATIONS

AFN	Acute Frality Network criteria
AF	Atrial fibrillation
ACEI	Angiotensin converting enzyme inhibitor
ARB	Angiotensin II receptor blocker
BNP	brain natriuretic peptide
BB	Beta-blocker
CFS	Clinical Frality Scale
CHF	Chronic heart Faliure
COPD	Chronic Obstructive Pulmonary Disease
CAD	Coronary Artery Disease
CHD	Congenital heart disease
CHF	Congestive heart faliure
CKD	Chronic Kidney Disease
CRT	Cardiac Resynchronisation Therapy
CGA	Comprehensive Geriatric Assesmemt
DCM	Dilated cardiomyopathy
DMP	Disease Management Program
DAI	Deficit Accumulation Index

DT	Destination Therapy
DHES	Dehydroepi-androsterone silphate
DI	Deficit index
DFI	Derby Frality Index
DM	Diabeties Mellitus
ED	Emergency Department
EFS	Edmonton Frality Scale
FP	Frality Phenotype
HFpEF	Heart Failure with Preserved ejection fraction
HfrEF	Heart Faliure with reduced ejection fraction
hsCRP	High senstivity C-Reactive protein
HF	Heart Faliure
HGS	Hand Grip Strength
IL	Inter Leukin
IHD	Ischemic Heart Disease
MRAs	Mineralocorticoid receptor antagonists
NT-pro-BNP	N-terminal pro-BNP
LVEF	Left ventricular ejection fraction
LVAD	Left Ventricular Assist Device

NF	Non-frail
NYHA	Newyork Heart assosiation
NE	Normal Endurance
QoL	Quality of Life
RHD	Rheumatic heart Disease
THFR	The Trivandrum Heart Failure Registry
TNFa	Tumor Necrosis Factor aplha
VHD	Valvular heart disease
6MWT	6 Minute walk Test

ABSTRACT

Introduction: Frailty has been studied extensively in elderly population as a predictor and prognostic marker for morbidity and mortality. In addition, frailty is being evaluated in patient cohorts in coronary artery disease, heart failure, stroke and other chronic diseases. Frailty is being increasingly recognised as a distinct pathophysiological condition which plays a major role in outcomes of various disease states.

Aims of the study: Our aim was to assess the handgrip strength as a predictor of prognosis in the patients with heart failure.

Materials and methods: This was a prospective study conducted at the OPD of Hero DMC heart institute, Ludhiana. All consecutive patients with heart failure, more than 40 years age, with the left ventricular ejection fraction <40 % at the time of enrolment and willing to participate in the study were included. Patients with neuromuscular disorder where handgrip could not be assessed were excluded from the study. All patients were asked a simple frailty questionnaire as given by Fried et al. Hand dynamometer was used to assess the handgrip strength in kilograms and were classified as frail or non-frail. The primary end point was cardiovascular mortality and re-hospitalization.

Results: The outcomes were analysed for 216 patients. There was significant difference (p=0.001) between the handgrip strength of the frail vs non/pre-frail patients, with weaker handgrip strength in the frail group. There was significantly greater mortality (p=0.001) and rehospitalisation in in the frail group compared to pre/non-frail patients.

CONCLUSION: Frailty is associated with a significant morbidity and mortality in heart failure with reduced ejection fraction. The prevalence of frailty in congestive cardiac failure is higher even at a comparatively younger age group. A simple bedside hand-held dynamometer may aid as a frailty screening tool in these patients and help in planning treatment strategies. Identification of frailty with simple Fried frailty index questionnaire may help in identification of these patients.

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INTRODUCTION

Heart failure is defined as a complex clinical syndrome attributed to various disarray of metabolic and neuroendocrine pathways along with end organ injury resulting from systolic and diastolic circulatory failure[1].

As the heart failure advances, it causes a decline in oxidative capacity of skeletal muscle along with reduced capillary density and cross sectional area of myocardial fibre[2, 3].

This deranged anatomy of muscular structure and metabolic functions ends up in decreased exercise tolerance and the frailty phenotype with increase in morbidity and mortality[4-6].

The burden of heart failure is increasing at an alarming rate in developed and developing countries[7]. Heart failure is associated with poor quality of life, shorter life expectancy, increase frequency of hospitalization causing a major socio economic impact on patient as well as healthcare system.

According to various Indian data and registry[8-13], the mean age of the affected population in India is ranging between 56 years to 61.2 years affecting male gender (62-83%) as compared to female gender.

There are multiple etiologies associated with heart failure like coronary artery disease (ischemic heart disease) , dilated cardiomyopathy , rheumatic heart disease (RHD), hypertensive heart disease, valvular heart disease out of which the most common being coronary artery disease (ischemic artery disease) the mean percentage ranging between 37.3% to 76.9% .Similarly there are numerous associated co morbidities associated with heart failure for instance hypertension, diabetes mellitus (DM), chronic kidney disease, chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD) atrial flutter, atrial fibrillation. The comorbidities play a vital role in deciding overall prognosis including morbidity and mortality of the patient. Different Indian data and registry mention the most common associated comorbidity being Hypertension (37% to 58%) then diabetes mellitus (23% to 48.8%).Hence the overall incidence is likely to increase if the following factors are associated like aging population, risk of coronary artery disease prevalence, epidemic

increment of comorbidities being most common hypertension and diabeties mellitus and persistence of rhematic heart disease and any untreated congenital heart disease (CHD)[11,14,15,16].

Heart faliure has apparently became a major global health issue with an approximated global prevalence of more than 37.7 million [17]. Data shows that the mortality rate is around 50% at 5 years from the initial diagnosis of heart failure[18]. HF is a leading cause of hospitalization and represents 1–5% of total hospital admissions[17,19,20]. About 2–17% of HF patients admitted to hospital die while in the hospital.3 Patients who survive have a high rate of rehospitalization and poor QoL[2,19]. Despite improvements in medical care over the years, the prognosis of patients with HF remains poor and the survival rate is worse than in those with breast, bowel or prostate cancer[19].

The current estimate regarding incidence of heart failure in India ranges in between 1.3 to 2.3 million[8]. The Trivandrum Heart Failure Registry (THFR) reported that HF with preserved ejection fraction accounted for 25% of the total heart failure burden. The prognosis of HF in Indian patients appears to be worse than those in the West. The in-hospital mortality observed in the THFR (8.4%) was almost double compared to that reported in the ADHERE registry (4%) of the USA. The INTER-CHF study also showed that the 1-year mortality of HF is high in India i.e., 37%. As HF presents about a decade earlier in Indians, it generally affects the patients in the crucial stage of their lives. Majority of the Indian patients are from low socio-economic strata, who have to spend out-of-pocket for their treatment, unlike in the West.

It is always aimed to initiate an appropriate treatment intending for better outcome of the patient in terms of reduction in morbidity and mortality, hospitalization duration, and health care cost. However, the diagnosis and high risk stratification of the patient is exigent at times. All of the patients do not exhibit typical symptoms and neither do all patients who give the impression of typical symptoms have heart failure. Therefore, it is of great magnitude and concern that there should be an accurate diagnostic tool

for evaluation and high risk stratification of the patient for prompt initiate of treatment. Identification should be the key aspect for accurate diagnosis to surpass the known consequences of heart failure. There are various pharmacological and non-pharmacological modalities for the treatment of heart failure at present. The pharmacological treatment modalities includes various drugs including Angiotensin converting enzyme inhibitors (ACEI) ,Angiotensin II receptor blockers (ARBs),Beta blockers, Diuretics, angiotensin receptor neprilysin inhibitors (ARNI), mineralocorticoid receptor antagonist (MRAs),Funny channel inhibitors like ivabradine. The Non Pharmacological treatment includes devices like implantable cardioverter defibrillators (ICD), cardiac resynchronization therapy (CRT), ventricular assist device (VAD)

Somehow, none of them includes frailty as an indicator of prognosis of the patient existing so far. As such there is no recommendation or recent guidelines that incorporates the physiological and anatomical changes in heart failure and association with frailty for high risk patient identification and which mode of treatment will be suitable to these patients in terms of their better outcome and prognosis. Hence it is desired that frality be incorporated in the management protocols of CHF as a marker of high risk correlating and be used to guide treatment strategies. This will further lead to an impactful reduction in morbidity and mortality of the patient including improved quality of life.

Frailty is a syndrome characterized by weakness, fatigue, and increased vulnerability to physiologic stressors. Although most often associated with aging, frailty is also a recognized component of chronic illness.

There are approximately 20 different scales that have been proposed to define and measure the syndrome of frailty[22]. The majority of these tools include a measure of at least one each of the five domains that make up the frailty phenotype[23].

Five Domains are:

1. Slowness
2. Weakness

3. Low physical activity
4. Exhaustion
5. Shrinking (decreased muscle mass)

Objective assessments of these domains are:

- 5 m gait speed test (slowness)
- Handgrip/knee extensor strength test (weakness)
- Questionnaires related to exhaustion/anergia, physical activity and unintentional weight loss.
- The Fried Frailty Index is one of the most widely used scales and incorporates all five criteria, with ≥3 of 5 required for a diagnosis of frailty[24]. Other scales use the above dimensions to a greater or lesser degree, particularly gait speed and handgrip strength [25-27].
- The phenotype of heart failure (HF) is associated with age. Various changes can be seen as the age advances, playing a distinctive challenge in the aging HF population with respect to diagnosis, prognosis, and outcomes. The prevalence of systolic dysfunction declines while the incidence of HF with preserved ejection fraction increases[28]. Moreover, common geriatric issues such as frailty, polypharmacy, and multi-morbidity are encountered more frequently. As such, the typical elderly HF patient is one with preserved ejection fraction, multiple non-cardiac comorbidities, and concomitant frailty[28,29].
- Almost 80% of HF patients are over age 65[30], with the incidence of HF doubling in each decade of life with an eventual rise to 20% in patients over 80 years old[31]. Using validated frailty assessment tools, current research is working to define the impact of frailty on HF diagnosis, prognosis, and treatment.
- Early identification of frailty as a syndrome and using its presence to guide management may ultimately improve patient-centred outcomes to a major fraction.
- The lack of physiologic reserve in frail patients allows for acute stressors to cause rapid functional deterioration and debility. In

addition to a two-fold increase in mortality risk, frail HF patients experience greater rates of hospitalization, endure longer lengths of stay, have increased risk for rehospitalisation, and report significantly lower scores with respect to quality of life[32-34] . Interestingly, it has been shown that a multidimensional prognostic index generated from a comprehensive geriatric assessment (including evaluation of functional status, cognition, social support, nutritional status, and others), outperformed HF indices for 30 day mortality risk[35]. This speaks to the difficulties of prognosis in this elderly population and suggests that outcomes are driven by multidimensional factors beyond disease-specific criteria.

- In addition to prognosis, the presence of frailty results in complexities with respect to diagnosis and treatment of HF. The symptoms of frailty mirror those of HF and manifest as a constellation of weakness, fatigue, and breathlessness. Frailty assessments are recommended in elderly patients to help differentiate symptoms[36]. Once HF is diagnosed, medical management is complicated by common geriatric maladies. Side effects of HF medications have the potential to exacerbate weakness, dizziness, and urinary incontinence, predisposing patients to adverse events such as syncope and falls. Additionally, polypharmacy in elderly patients is a known risk factor for negative outcomes. Due to underrepresentation in clinical trials, evidence is lacking for guideline directed medical management in this age group. Consequently, elderly frail patients are less likely to receive standard HF regimens[37]. There is data, however, that suggests that frail HF patients benefit more than non-frail HF patients from an interdisciplinary approach to management[38]. This approach utilizes cardiologists, primary care physicians, and specialized nurses in both inpatient and outpatient settings to optimize medical therapies, improve transitions of care, provide education, and monitor for development of HF signs and symptoms. Exercise programs have

also been shown to have benefits with respect to functional capacity, quality of life, hospitalization and survival in HF[39-42].

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AIMS AND OBJECTIVES

1. To assess the role of handgrip strength as a predictor of prognosis in patients of CHF.

2. To assess the correlation between progression in cardiac functions and handgrip strength with duration of heart failure

REVIEW OF LITERATURE

1. DEFINITION

Congestive heart failure (CHF) is considered as one of the most leading cause of morbidity and mortality in India and worldwide. It has become a global health priority. The burden of heart failure is on rise at an alarming rate worldwide as well as in India. Heart failure not only increases the risk of mortality, morbidity and affects the patient's quality of life, but also puts a huge burden on the overall healthcare system. The management of heart failure has evolved over the years with the advent of new drugs and devices but no standard protocol has been developed so far for the screening and evaluation of high risk patient.

Frailty word is derived from the Latin word 'fragilitas' that is defined as the condition of being weak and delicate. Previous studies in patients have shown that hand grip strength is associated with physiological and clinical cardiovascular biomarkers.

Frality is an indicator of poor prognosis and high risk of heart failure patients. The patients that are frail are at risk for higher mortality and morbidity. However, there is no standard way for the assessment and recognition of frail patients with chronic heart failure.

2. HISTORY

Frailty is defined as a common geriatric syndrome associated with loss of functionality leading to an increased risk of adverse health events.

The most common definitions that have been used to determine frailty within a CHF population were the frailty phenotype (FP)[23] and a comprehensive geriatric evaluation (CGA)[43,44].

The FP [24] was developed and validated by Fried and colleagues in the Cardiovascular Health Study (CHS) and describes a patient as frail when three or more attributes are present from five specific measures: unintentional weight loss, exhaustion, slow walking speed, weakness and low physical activity.

The second most common frailty measure used within a CHF population was a comprehensive geriatric assessment (CGA). This more holistic

approach involved the inclusion of four validated geriatric tools to assess domains of functional autonomy, cognitive deterioration, emotional disturbances and social risk[45,33].

Identification of frailty in chronic heart failure

The tools for the evaluation of the Frailty emerge from the two basic concepts of frailty being the physical frailty and the multidimensional frailty.

Physical frailty was proposed by Fried and colleagues[24] who defined frailty as a physical syndrome five criteria known as Fried Criteria: weak grip strength, unintentional weight loss, exhaustion, slow walking speed and low physical activity.

1. Unintentional shrinking: body mass index (BMI) of less than 18.5 kg/m2 and/or unintentional weight loss of 10 pounds (4.5 kg) or more in the past 6 months.

2. Slowness was assessed using the 6-meter fast gait speed test, using the average of 2 measurements, and the lowest quintile values stratified for gender and height to classify participants as slow.

3. Weakness: leg muscle strength was determined using dominant knee extension, using the average value from 3 trials in kilograms, standardized on gender and BMI strata. Participants with knee extension strengths in the lowest quintiles were classified as weak.

4. Exhaustion was measured with 3 questions on vitality domain in the Medical Outcomes Study SF-1228: “Did you feel worn out?” “Did you feel tired?” “Did you have a lot of energy?” with total summed scores ranging from 3 to 15, and a higher score indicating more energy. A score of less than 10 was used to denote exhaustion.

5. Low activity: physical activities were assessed based on self-reported time (in hours) spent doing light (eg, office work, driving a car, strolling, standing with little motion, personal care), moderate, and vigorous activities (eg, gardening, brisk walking, dancing, jogging, swimming, strenuous sports) on weekdays and the weekend. The total amount of time spent on performing moderate and vigorous activities per week and

activity time below the gender-specific lowest quintile was used to denote frailty on this criterion.

The second concept was proposed by Rockwood et al[46,47] who defined frailty as a state of vulnerability resulting from accumulation of health deficits.

Another tool for the assessment of Frailty is the Edmonton Frailty scale (EFS) is a simplified tool based on the concept of multidimensional frailty that has been shown to have good construct validity and reliability[48].

FRALITY SCREENING AND ASSESMENT tools:

The screening tools commonly used are:

1. **The Derby frailty index** (DFI; scores as frail vs. non-frail) DFI is a quick, pragmatic frailty identification tool initially developed in 2013[49].

   A patient is classified as frail if 1 of the following criteria is met: 1) >65years of age and a care home resident; 2) more or equal to75 years of age with confusion, falls, or reduced mobility; 3) more or equal to 85 years of age with >4 comorbidities.

2**. The acute frailty network criteria** (AFN; scores as frail vs. non-frail) AFN defines frailty as present in: 1) people age >85 years; or 2) people age >65 years with 1 or more of the following presenting features: cognitive impairment; resident in a care home; history of fragility fractures; Parkinson disease; or recurrent falls[50]**.**

3. **The clinical frailty scale** (CFS; measures between1 [very fit] and 9 [terminally ill])

Subjects are scored according to their functional capacity, level of dependence, and comorbidities.

For example, a patient with uncontrolled symptoms who is not frankly dependent is classified as vulnerable and scores 4 on the CFS, whereas an individual with limited dependence on others for instrumental activities of daily living, including finances, transportation, heavy housework, and medications, will be classified as mildly frail and scores 5 on the CFS. Subjects with a CFS >4 are classified as frail [**51**].

The assessment tools commonly used are:

1. **Fried Frailty phenotype** (measures between 0 [normal] and 5 [very frail])

The Fried Frailty phenotype[24] is commonly used to validate other frailty criteria. Frailty is considered a clinical syndrome based on 5 criteria:

1. unintentional weight loss (>10 lbs [>4.5 kg] in the past year);
2. self-reported exhaustion and
3. Weakness (low grip strength)
4. slow walking speed (time to walk 5 m >6 to 7 s depending on sex and height);
5. low physical activity (low weekly total energy expenditure assessed using the short version of the Minnesota Leisure Time Activity questionnaire)[52]

Subjects with ≥3 points are classified as frail and those with 1 to 2 points and 0 points are classified as pre-frail and non-frail respectively.

2. **Edmonton frailty scale EFS (measures between 0 and 17)**

EFS is a multidimensional frailty assessment tool that includes general health status, functional independence, social support, cognition, medication use, nutrition, continence, and mood[53]. It has been validated against the comprehensive geriatric assessment[54], a multidimensional, multidisciplinary diagnostic process used to determine medical, functional, and psychosocial problems in elderly patients[53].

Subjects with an EFS 0 to 5 are classified as non-frail; those with an EFS of 6 to 7, 8 to 9, 10 to 11, and 12 to 17 are classified as vulnerable, mildly, moderately, and severely frail, respectively. Subjects with an EFS ≥8 are classified as frail

3. **Deficit Index (DI)**. DI (measures between 0.03 and 0.72)

Mitnitski and Rockwood[55] consider frailty as a clinical state as a result of accumulation of deficits (symptoms, signs, comorbidities, and disabilities). These deficits are combined in an index score to reflect the proportion of potential deficits present in a person.

PHYSICAL TESTS.

1. **Handgrip strength**

Handgrip strength is obtained with a handgrip dynamometer. The subject is seated with fore arm resting on the arm of a chair and instructed to hold the dynamometer upright and squeeze as hard as possible. Three trials in the right hand followed by 3 trials in the left hand were recorded and the highest reading of the 6 was taken as the final reading.

2. Gait analysis

A. Timed get up and go test. The area for the timed get up and go test is set up by measuring 3 meters from the front legs of a straight-backed armchair. The subject is instructed to sit with his or her back against the chair and your arms on the arm rests. On the word ‘go,’ patient is asked to stand upright, then walk at his or her normal pace to the line on the floor, turn around, return to the chair, and sit down.” The time required to complete the test was time from the word ‘go’ to time when the subject returned to the starting position. Subjects who takes >10 s to complete the test are classified as frail.

B. 5-m walk test

The subject is instructed to walk at a normal pace for 5 m according to their ability. The time required to complete the test was time from the word ‘go’ to the time when the subject reached the 5-m point. Subjects who took >6 to 7 s (depending on sex and height) to complete the test were classified as frail

3. EPIDEMIOLOGY

Global data

Heart failure has emerged as a major global health issue, with an estimated worldwide prevalence of >37.7 million[56]. The burden is rapidly increasing and it is projected that by 2030, the number of HF patients would rise by 25%[57].

At 55 years of age, the lifetime risk of HF is 33% and 28.5% for men and women, respectively[58]. The exponential rise in the incidence of hypertension and DM over the last couple of years has shaped the trajectory of HF development seen today.

Common risk factors associated with CHF and causes of HF are IHD, Hypertension, DM, AF, CKD, VHD.

Data indicates that the mortality rate is ~50% at 5 years from the initial diagnosis of HF[59]. HF is a leading cause of hospitalization and represents 1–5% of total hospital admissions[60,56]. About 2–17% of HF patients admitted to hospital die while in the hospital[60]. Patients who survive have a high rate of rehospitalization and poor QoL[60,21]. Despite improvements in medical care over the years, the prognosis of patients with HF remains poor and the survival rate is worse than in those with breast, bowel or prostate cancer[60].

Indian data

The current estimates about incidence of HF in India vary widely from 1.3 to 23 million[8]. The Trivandrum Heart Failure Registry (THFR) reported HFpEF accounted for 25% of the total HF burden, indicating that in Indian clinical practice, HFrEF is predominantly observed. There are also various differences in the patient profile of the Indian CHF patients as compared to the patients in the western countries. The Indian patients tend to be younger than the CHF patients in the western countries as evident in the Medanta registry and the Indian arm of INTER CHF registry. The male to female ratio is also more in the Indian subset. Ischemic heart disease is the most common etiology in India too, but rheumatic heart disease forms a major fraction. Diabetes is much more prevalent in the Indian population of Heart failure as compared to the western patients as shown by Trivandrum Heart Failure registry. The prognosis of heart failure patients in India is worse than the patients in the west. Trivandrum registry showed a mortality of 8.4% which is double to that of the mortality seen in ADHERE registry in the USA.

4. ETIOPATHOLOGY

Pathophysiologic Mechanisms

The pathophysiologic mechanism linking HF and frailty is incompletely understood. Patients with HF are up to six times more likely to be frail, and frail patients have a significantly increased risk of developing new onset

HF[61,62]. This relationship is thought to rest on a shared mechanism of inflammation, metabolic dysfunction, and hormonal dysregulation. The presence of inflammatory markers such as C-reactive protein, interleukin-6, and tumor necrosis factor-α correlate both with incident HF events as well as development frailty components such as skeletal muscle wasting, cardiac cachexia, sarcopenia, physical dependence and weakness[63,64]. Frailty and HF are also both associated with insulin resistance, abnormal cortisol patterns, and steroid hormone deficiencies[23]. In HABC study[61] frailty severity was associated with the increasing inflammatory markers, glycaemia and adiposity. Potentially, the inflammation, metabolic derangements, and hormone deficiencies contribute to subclinical cardiovascular disease, which in turn acts as foundation for development of overt cardiovascular disease, frailty, or both[23].

It is important to note that although linked to aging, frailty is not synonymous with it. With age, people accumulate functional and physiologic deficits, but the degree to which these deficits affect each person varies widely.

Chronological age alone does not predict vulnerability to adverse outcomes and, as a corollary, a younger age does not preclude the presence of frailty in the setting of a chronic disease. Sorting out those aspects of chronic illness (reduced functional capacity, susceptibility to infectious disease) that are due to the illness itself, rather than frailty, can be a difficult task[65].

It has been proposed that frailty as a phenotype is made up of potentially reversible and non-reversible aspects[66]. In HF patients, if appropriately timed interventions can be undertaken (e.g., advanced HF therapies; minimally invasive valve repairs), it may be possible to reverse the disease-specific aspects of the perceived frail patient, and therefore reverse the frailty phenotype. This hypothesis is currently under study in a multi-center trial evaluating patients receiving left ventricular assist devices (LVAD) as destination therapy.

Frailty and Consideration of Advanced Therapies for Heart Failure

In addition, consideration of advanced HF therapies (e.g., LVADs, heart transplantation) may be complicated by underlying frailty and concern for clinical outcomes[67].

In a study at a major transplant center, patients referred or waitlisted for heart transplant were evaluated for frailty. Of these patients, 33% were determined to be frail. Frailty was associated with NYHA Class IV symptoms, lower BMI, higher intracardiac filling pressures and lower cardiac index, cognitive impairment and depression. Most interestingly, frailty was not associated with sex, age, LVEF or HF duration. Frailty was an independent predictor of increased all-cause mortality. Similar findings have been reported in patients undergoing lung transplantation[68,69]. A determination of frailty as an independent marker of outcomes should therefore be considered as part of the evaluation process of patients for advanced HF therapies.

Overall, the therapeutic implication for elderly HF patients with frailty is to deliver patient-centered goal-oriented care[35]. In this generally older population, treatments plans may prioritize symptom management, functional status, and quality of life over survival.

A comprehensive assessment, including that of frailty, is therefore an essential component to patient evaluation, as it provides meaningful information with respect to diagnosis, prognosis, and management. Additionally, an interdisciplinary care team approach targeting the multidimensional aspects of health may ultimately improve health-related quality of life and overall well-being in this complex patient population.

Classification of heart failure[70,59,71]

1. Stable HF: When a HF patient on treatment does not exhibit any major change in the symptoms and signs of HF for at least one month, then the patient's condition is referred to as "stable".

2. Decompensated HF: When the condition of a "chronic" previously "stable" HF patient deteriorates suddenly or slowly, it is referred to as "decompensated".

3. New-onset/de novo HF: A patient with new-onset/de novo HF may present with symptoms in an acute or subacute (gradual) fashion.

4. Advanced HF: It refers to patients with severe cardiac dysfunction, recurrent decompensation and severe symptoms despite optimal standard medical therapy.

5. PROGNOSIS FACTORS MARKERS

As such there are no standard markers or method for evaluation of frailty in CHF patients. Frality and heart failure both are the clinical syndromes that presents with overlapping phenotypic characterstics.

6. TREATMENT MODALITIES

Successful management of HF involves patient education, non-pharmacological management, pharmacological management and, in certain scenarios, implantation of devices and/or the option of revascularization.

Currently there is no risk factor scale that identifies older persons at risk of frailty. Various studies are ongoing for accuracy and validation of such scales till date.

Tze Pin Ng et al[72] did a study that identified significant multisystem risk factors of frailty, they developed a simple frailty risk index, and evaluated it for use in primary care on an external validation cohort of community living older persons. They used cross-sectional data of 1685 older adults aged 55 and older in the Singapore Longitudinal Ageing Studies (SLAS) to identify 13 salient risk factors among 40 known and putative risk factors of the frailty phenotype (weakness, slowness, low physical activity, weight loss, and exhaustion). In a validation cohort (n ¼ 2478) followed for 2 years, they evaluated the validity of Frailty Risk Index (FRI).

Their main Outcomes and Measures were Frailty at baseline and functional dependency, hospitalization, and SF12 physical component summary (PCS) scores at 2-year follow-up were measured among people in the validation cohort.

They found that components (weighted scores) of the FRI are age older than 75 (2), no education (1), heart failure (1), respiratory disorders (2),

stroke (2), depressive symptoms (3), hearing impairment (3), visual impairment (1), FEV1/FVC lower than 0.7 (1), eGFR lower than 60 mL/min/1.73m2 (1), nutritional risk score of 3 or higher (2), anemia (1), and white cell counts (109/L) of 6.5 or more (1).

In the validation cohort, the FRI (0 to 12) was significantly associated with prefrailty and frailty and concluded that the FRI is a validated instrument for assessing frailty risk in community-living older person and it can be a useful rapid assessment tool to identify vital body system deficits underlying the frailty syndrome.

Frailty is common in patients with CHF. There are many available frailty tools, but no standard method for evaluating frailty.

Similarly, **Shirley Sze et al,(2019)**[46] did a study on Identification of Frailty in Chronic Heart Failure to report the prevalence of frailty, classification performance, and agreement among 3 frailty assessment tools and 3 screening tools in chronic heart failure (CHF) patients.

They used the following frailty screening tools: the clinical frailty scale (CFS); the Derby frailty index; and the acute frailty network frailty criteria. They used the following frailty assessment tools: the Fried criteria; the Edmonton frailty score; and the Deficit Index and found a total of 467 consecutive ambulatory CHF patients (67% male; median age: 76 years; interquartile range [IQR]: 69 to 82 years; median N-terminal pro–B-type natriuretic peptide: 1,156 ng/l [IQR: 469 to 2,463 ng/l]) and 87 control patients (79% male; median age: 73 years (IQR: 69 to 77 years) were studied. The prevalence of frailty using the different tools was higher in CHF patients than in control patients (30% to 52% vs. 2% to 15%, respectively). Frail patients tended to be older, have worse symptoms, higher N-terminal pro–B-type natriuretic peptide levels, and more comorbidities. Of the screening tools, CFS had the strongest correlation and agreement with the assessment tools. CFS had the highest sensitivity (87%) and specificity (89%) among screening tools and the lowest misclassification rate (12%) among all 6 frailty tools in identifying frailty according to the standard combined frailty index. They concluded that

CFS is a simple screening tool that identifies a similar group using more lengthy assessment tools.

Another review by **Erik Fung et al**[73] was done on Heart Failure and Frailty in the Community Living Elderly Population. They reviewed the problematic interactions between heart failure and frailty, introduced a focused cardiac screening program for community-living elderly initiated by a mobile communication device app leading to the Undiagnosed heart Failure in frail Older individuals (UFO) study, and discussed how the knowledge of pre-frailty and frailty status could be exploited for the detection of previously undiagnosed heart failure or advanced cardiac disease.

A study was done by **Fried LP et al (2001)**[24] on Frailty in Older Adults on the Evidence for a Phenotype that aimed to develop and operationalize a phenotype of frailty in older adults and assess concurrent and predictive validity, the study used data from the Cardiovascular Health Study including the participants with 5,317 men and women 65 years and older (4,735 from an original cohort recruited in 1989–90 and 582 from an African American cohort recruited in 1992–93).

Both cohorts received almost identical baseline evaluations and 7 and 4 years of follow-up, respectively, with annual examinations and surveillance for outcomes including incident disease, hospitalization, falls, disability, and mortality.

They found that Frailty was defined as a clinical syndrome in which three or more of the following criteria were present: unintentional weight loss (10 lbs in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity. The overall prevalence of frailty in this community-dwelling population was 6.9%; it increased with age and was greater in women than men. Frailty was associated with being African American, having lower education and income, poorer health, and having higher rates of comorbid chronic diseases and disability. There was overlap, but not concordance, in the co-occurrence of frailty, comorbidity, and disability.

This frailty phenotype was independently predictive (over 3 years) of incident falls, worsening mobility or ADL disability, hospitalization, and death, with hazard ratios ranging from 1.82 to 4.46. Intermediate frailty status, as indicated by the presence of one or two criteria, showed intermediate risk of these outcomes as well as increased risk of becoming frail over 3–4 years of follow-up.

This study provided a potential standardized definition for frailty in community-dwelling older adults offering concurrent and predictive validity for the definition. It also founded that there was an intermediate stage identifying those at high risk of frailty. This provided a potential basis for clinical assessment for those who are frail or at risk, and for future research to develop interventions for frailty based on a standardized ascertainment of frailty.

Miller et al (2000)[74] found that walking about 1 mile per week was linked to gradual development of functional limitations over a follow-up of 6 months.

Similarly another systematic review study was done by **Julee McDonagh et al (2018)[75],** on Frailty assessment instruments in heart failure. They aimed to identify how frailty is assessed in individuals with heart failure and to elucidate which domains of frailty that were most frequently assessed. They searched Key electronic databases (MEDLINE, COCHRANE Central and CINAHL) to identify studies that assessed frailty in individuals with heart failure using a formal frailty instrument. They identified Twenty studies published in 24 articles were included, for which a total of seven unique frailty instruments). The most commonly utilized frailty instruments (n=11 (55%)) were based on Frailty Phenotype (FP), 5 with the majority (n=8) using modified versions of the original tool17, 21–28 with one study assessing a single-item component. The second most commonly utilized instrument was the Comprehensive Geriatric Assessment (CGA) (n= 4), followed by the Deficit Accumulation Index (DAI) (n=2).

A Case control study was conducted by **Abou Raya (2009) et al**[76], evaluating the association between osteoporosis and CHF including 137 participants (83 CHF and osteoporosis, 54control) of Outpatient clinic. The instrument used was FP (modified) with the domain Physical: weight loss, exhaustion, walking speed and HGS. They found that in CHF group the mean age was 69.9± 4.5 years with 51% being females. Whereas, in Control group: mean age was 70.1 ± 3.9 years with 52% being females. Similarly in the CHF group, the percentage of frail patients were 29% including Pre-frail and Not frail being 43% and 28% respectively.in the Control group:

There were no frail patients with percentage of Pre-frail and Not frail being 46% and 56% respectively. Also the Levels of IL-6 and TNF-α were found to be significantly higher in CHF group compared with Controls with a significant p value (p= 0.001 and p=0.005).

Another Cross sectional study by **Altimir et al. (2005)**[45], was done on 360 participants of Outpatient HF clinic to describe the degree of frailty in patients treated in a HF clinic and to evaluate age and sex differences using the CGA to measure frailty. They found that Mean age was 65.2 ± 10.9 years with 74% as female including 42% as Frail patients. They also found that Frailty was strongly associated with anaemia ($p<0.001$) and diabetes ($p=0.002$). Abnormal Pfeiffer cognitive test was found in 8% of patients. Frailty was also strongly correlated with number of hospital admissions.

Similarly, **Boxer et al. (2008)**[77]**,** conducted a study to identify the relationships between anabolic hormones, inflammatory markers and physical function on 60 Outpatient university HF program participants using FP (modified). Physical: weight loss, exhaustion, walking speed, physical activity level and HGS 6MWT as domains. They found that the Mean age was 78±12 years with 28% were female. The Frail and Pre-frail patients being 25% and 45% respectively and 28% being Not frail. Higher FP score was correlated with higher hsCRP, higher IL-6 and lower vitamin D (all $p<0.05$).

Another study conducted by **Boxer et al. (2010)**[78,79] **,**was done to determine if HF contributes to the development of functional decline and frailty including 20 participants Outpatients from the follow-up of participants from a previous observational study using FP (modified) as an instrument for frailty. The domains used were Physical: weight loss, exhaustion, walking speed, physical activity level and HGS 6MWT.They found that there were no changes in frailty/ endurance status over time.**The FRAIL HF, by Vidan et al**, **(2014)**[80]**,**to evaluate the clinical complexity of heart failure in nondependent older patients: rationale, methods and baseline characteristics a prospective cohort study including 450 non-dependent patients aged ≥70 years who had been hospitalised for HF, evaluated the relationships between the frailty phenotype and associated issues (i.e. comorbidities, coexistent geriatric syndromes, self-care and social support) with clinical, functional and quality-of-life outcomes. The study found that even in non-dependent patients, frailty was a risk factor for early disability, long-term mortality and hospital readmission. FRAIL-HF was a prospective observational cohort study designed to evaluate clinical outcomes (mortality and readmission), functional evolution, quality of life, and use of social resources at 1, 3, 6, and 12 months after admission in nondependent elderly patients hospitalized for HF. Clinical features, medical treatment, self-care ability, and health literacy were prospectively evaluated and a comprehensive geriatric assessment with special focus on frailty was systematically performed in hospital to assess interactions and relationships with post discharge outcomes.

A review study by Olga Theou et al (2018)[81], was done to know about the frailty in the acute care setting that included original research articles with acutely-ill Emergency Medical Services (EMS) or hospitalized older patients who were identified as frail by the authors. They searched Medline, CINAHL, Embase, PsycINFO, Eric, and Cochrane from January 2000 to September 2015 and found 8658 articles initially and 617 were eligible.

Among the 204 articles that did measure frailty, the most common disciplines were geriatrics (14%), emergency department (14%), and general medicine (11%). In total, 89 measures were used. This included 13 established tools, used in 51% of the articles, and 35 non-frailty tools, used in 24% of the articles.

The most commonly used tools were the Clinical Frailty Scale, the Frailty Index, and the Frailty Phenotype (12% each). Most often (44%) researchers used frailty tools to predict adverse health outcomes. In 74% of the cases frailty predicted the outcome examined, typically mortality and length of stay.

Most studies (83%) were conducted in non-geriatric disciplines and two thirds of the articles identified participants as frail without measuring frailty. There was great variability in tools used and more recently published studies were more likely to use established frailty tools.

Few studies have focused on frailty as a predictor of mortality and readmission among inpatients in the acute care setting, especially over long follow-up periods.

Such a prospective observational study was conducted by **Qiukui Hao** et al (2019)[82], establishing the role of frailty in predicting mortality and readmission in older adults in acute care wards. This was conducted to determine the impact of the frailty on subsequent mortality and readmission in this setting. This study was conducted in the acute geriatric wards, with a three-year follow-up duration. They assessed frailty via the 36-item Frailty Index, and a cut-off value of 0.25 was used to identify the presence or absence of frailty. They collected survival and readmission information through telephone interviews at 12, 24, and 36 months. One hundred and thirty-three patients (49.1%) were identified as being frail. The prevalence of frailty was similar in men and women (46.8% vs.58.2%, P = 0.130). Compared with non-frail patients, death and hospital readmission rates of frail patients were increased. Frailty was an independent predictor of 3-year death and readmission after adjusting for several potential confounders. Frailty was prevalent among older

inpatients and is a valuable predictor of 3-year mortality and hospital readmission in an acute care setting.

Heart failure is associated with the derangement of muscle structure and metabolism, contributing to exercise intolerance, frailty, and mortality. Reduced handgrip strength is associated with increased patient frailty and higher morbidity and mortality. Several components of the frailty score such as slowness, self-reported exhaustion, and low physical activity are nearly consistent findings in patients with advanced HF, which suggests that both frailty and HF share common biological mechanisms. For example, unintentional weight loss is a sign of cardiac cachexia and the progressive catabolic state that is part of the advanced HF syndrome, whereas it is also a cardinal feature of the frailty phenotype. This measure might largely be determined by underlying comorbidities rather than representing a specific manifestation of frailty. Among the components of the Fried frailty score, handgrip strength has the highest potential to be a specific measure of frailty that can be readily assessed in a physically compromised or even bed-ridden patient population. It is, therefore, also applicable to patients with highly compromised hemodynamic state (Interagency Registry for Mechanically Assisted Circulatory Support 1-3) in addition to patients who are not hospitalized but show signs of worsening HF state (Interagency Registry for Mechanically Assisted Circulatory Support 4–7). Measuring HGS requires minimal equipment and time, and is convenient for the hospital staff, is well-tolerated even by wheelchair-and bed ridden patients.

A study conducted by **Christine j. Chung** et al,(2014)[83], on reduced handgrip strength as a marker of frailty as a predictor of clinical outcomes in patients with heart failure undergoing ventricular assist device placement .Handgrip strength was measured in 72 patients with advanced HF before VAD implantation (2.3 ± 4.9 days pre-VAD). They analyzed dynamics in handgrip strength, laboratory values, postoperative complications, and mortality. Handgrip strength correlated with serum albumin levels (P = 0.004). Compared with baseline, handgrip strength

increased post-VAD implantation by 18.2 ± 5.6% at 3 months (n = 29) and 45.5 ± 23.9% at 6 months (n = 27). Patients with a handgrip strength <25% of body weight had an increased risk of mortality, increased postoperative complications, and lower survival after VAD implantation. Patients with advanced HF show impaired handgrip strength indicating a global myopathy. Handgrip strength <25% of body weight was associated with higher postoperative complication rates and increased mortality after VAD implantation. The addition of measures of skeletal muscle function underlying the frailty phenotype to traditional risk markers have incremental prognostic value in patients undergoing evaluation for VAD placement.

A study conducted by **Miguel K. Rodrigues** et al (2017)[84] and found that Pre-Frailty Increases the Risk of Adverse Events in Older Patients Undergoing Cardiovascular Surgery.

They investigated the main outcomes (length of stay, mechanical ventilation time, stroke and in-hospital death) in pre-frail patients in comparison with no-frail patients after cardiovascular surgery on 221 patients over 65 years old, with established diagnosis of myocardial infarction or valve disease. Patients were evaluated by Clinical Frailty Score (CFS) before surgery and allocated into 2 groups: no-frailty (CFS 1~3) vs. pre-frailty (CFS 4) and followed up for main outcomes. Pre-frail patients showed a longer mechanical ventilation time than no-frail patients; similar results were observed for length of stay at the intensive care unit and total time of hospitalization. In addition, the pre-frail group had a higher number of adverse events (stroke 8.3% vs. 3.9%; in-hospital death 21.5% vs. 7.8%; $p < 0.05$). Moreover, higher number of pre-frail patients required homecare services than no-frail patients (46.5% vs. 0%; $p < 0.05$). Patients with pre-frailty showed longer mechanical ventilation time and hospital stay with an increased risk for cardiovascular events compared with no-frail patients.

Buck and Riegel (2011)[85] conducted a secondary analysis to determine if frailty explains the variability of HRQL in older adults with heart failure

including 130 participants using Novel frailty instrument. Domains used were age, comorbidities (Charlson index), symptom severity (fatigue, dyspnoea on exertion and chest pain).They found that median age of 72 years Frailty negatively impacts HRQL in older adults with heart failure.

Cacciatore et al. (2005)[86] similarly conducted a case controlled study to examine the predictive role of frailty in predicting on long-term mortality in subjects with CHF 1259 participants (120 with CHF and 1139 without) Outpatients. Instrument used was Frailty staging system. Disability, mobility, cognitive function, visual function, hearing, urinary continence and social support were used as domains. They found that the CHF group had mean age 75.9 ± 6.7 out of which 60% were female including 15% as frail patients. Also death progressively increased with frailty in subjects with or without CHF.

Similarly**, Dominguez-Rodriguez** et al. (2015)[84] conducted a prospective study to assess the impact frailty status has on post implantation outcomes after cardiac resynchronisation therapy defebrilator (CRT-D) including 102 participants. Frailty Phenotype was used as an instrument with domains used were Physical including weight loss, exhaustion, walking speed, physical activity level and HGS**.** Barthel Index also collected as additional measure. They found that the Mean age was 73 ± 3 years including 53% were male out of which 28% were frail and 72% were non-frail. More frail patients experienced decompensated HF after CRT-D implantation than non-frail patients (51.7% vs. 16.4%, with a p value of < 0.001).

Dunlay et al. (2014) [87] also conducted an observational study to assess the postoperative outcomes associated with frailty in patients undergoing LVAD implantation as destination therapy including 99 participants. DAI was used as an instrument with domains as Index based on 31 deficits related to: self-care, activities of daily living, medical conditions, comorbidities and depression. They found that the mean age 65.1 ± 9.4 year and 82% were male including 34%, 33%, 32% frail, Intermediate frail

and not frail respectively. One year mortality rates were 16.2%, 21.2% and 39.9% (p= 0.007) for not frail, intermediate frail and frail respectively.

Chung et al. (2014)[83], conducted an observational cohort study to establish the predictive value of hand grip strength as a marker of frailty in VAD patients including 72 participants Pre-operatively. Domains used were handgrip strength measured pre VAD implant and monthly for six months post.

They found that the mean age of patients 59 ± 2 years with 22% and 78% frail and not frail respectively. Also **l**ow HGS correlated with low albumin levels. Baseline HGS was lower in patients who died post VAD implant. Patients with HGS <25% of body weight had significantly higher rates of bleeding postoperatively (54% vs. 17%, pvalue of 0.002) and higher infection rates (85 vs. 54%, p value 0.012).

Similarly, Ferguson et al. (2016)[88] did a study to describe the clinical characteristics of patients admitted to hospital with CHF and atrial fibrillation enrolling 137 participants including Inpatients**.** SHARE Frailty index was used as an instrument.

Five physical domains of frailty they used including appetite, exhaustion, walking speed, physical activity level and HGS .they found that the mean age was 72±16 with 65% were male and 92 participants had frailty assessed including 63% as frail patients. Also being frail and having higher comorbidity was associated with not receiving anticoagulant drugs at discharge.

Gastelurrutia et al. (2013)[89,90] conducted an observational study to assess the relationship between fragility and QoL perceptions in HF 1405 participants with 1314 participants Outpatients CGA as an instrument was used. The domains used were Physical and functional including Barthel Index of Activities of Daily Living and OARS scale, cognitive, Pfeiffer test, psychosocial depression and social interview Quality of life Minnesota living with HF questionaire. They found that the mean age was 66.7 ± 12.4 years out of which 72% were male including 44%.frail patients.

Jha et al. (2016)(67) also did an Observational study to determine the prevalence of frailty in patients referred for heart transplantation including 120 participants with hospital inpatients and outpatients seen in HF clinic
They used FP (modified) as an instrument with five physical domains: appetite, exhaustion, walking speed, physical activity level and HGS. Cognitive and depression screening was also undertaken.
They found that the mean age was 53 ± 12 years with 69% as male patients including Frail 33% and Not frail 68%. There was a significant difference in overall survival with more deaths occurring in the frail group ($p< 0.005$).
Lupon et al. (2008)[33] also conducted an Observational study to determine the impact of frailty and depressive symptoms on the one year mortality/hospitalization rate of individuals with HF 622 participants of Outpatient HF unit. CGA was used as an instrument with domains used were Physical/functional: Barthel Index of Activities of Daily Living and OARS scale, cognitive: Pfeiffer test, psychosocial: depression and social interview. They found that the median age to be 68 years with 73% male. Frail patients were 40%. After one year follow-up they found that 60 participants (10%) had died and 101 (17%) had heart failure hospitalizations. Presence of frailty was strongly associated with increased one year mortality.
Higher mortality in frail patients was observed in ≥70 years and in younger patients. The presence of frailty was also associated with increased HF hospitalization.
Madan et al. (2016)[91] did a single-centre pilot study to investigate the utility of frailty assessment in advanced HF including 40 participants including Outpatients in heart failure clinic. Instrument used was FP (modified) and 6MWT**.** Five domains were used including weight loss, exhaustion, walking speed, physical activity and HGS 6MWT.They found that the mean age was 74.9 ± 6.5 years including 58% as female and Frail and Pre-frail 65% and 35% respectively. There were no not-frail patients. There were more all cause hospitalizations in the frail vs. pre-frail group (p

value of 0.017). The 6MWT was not predictive of either of the primary end points and did not correlate to frailty score.

McNallan et al. (2013)[44,92] similarly conducted an observational study to determine the prevalence of frailty in a community cohort of patients with HF and to determine if frailty increases health care utilization 448 participants with Outpatients and Sub study of 223 patients11 Instrument used was FP including the Five domains: weight loss, exhaustion, walking speed, physical activity and HGS .They found that the mean age was 73 ± 13 years with 57% male patients and Frail and Intermediate frail 9% and 55% respectively. Frailty was associated with a 92% increased risk for ED visits and a 65% increase for hospitalizations.

Mlynarska et al. (2016)[93] conducted a Prospective cohort study to establish the degree of frailty in patients with advanced HF receiving CRT 106 participants. Clinician rated frailty rating scale domains were used including physical activity level, disability/dependence on others, comorbidity, activity level .They found that the mean age was 74.9 ± 6.3. Frailty syndrome was found in de novo group with frail = 82% frail patients and upgrade group had frail patients including 69%.

Newton et al. (2016)[94] did a Prospective audit to provide an insight into the acute HF admissions in New South Wales W and the Australian Capital Territory including Convenience sample of 811 patients **(**Inpatients). Five physical domains of frailty were included including appetite, exhaustion, walking speed, physical activity level and handgrip strength. They found that the mean age was 77 ± 13 years with 58% were male. 557 participants underwent a frailty assessment which showed 71% and 21% frail and Pre-frail patients respectively.

Pulignano et al. (2010)[38] did a randomized control trial to determine which patient's benefit mostly from Disease management program (DMP). Physical/functional domains used were Barthel Index of Activities of Daily Living and OARS scale, cognitive Pfeiffer test, psychosocial, depression and social interview. They found that in the DMP group the mean age was found to be 74.4 ± 5.9 with 51% male whereas, Usual care group

had Mean age of 75.5 ± 5.7 with 53% male including 79% and 21% Not frail and non- frail respectively. The DMP intervention was more cost effective in moderately frail patients than usual care.

Vidan et al. (2016)[95] did an observational cohort study to evaluate clinical outcomes (death and rehospitalization), functional evolution, QoL and use of social resources in elderly patients hospitalized for HF including 450 participants with Consecutive elderly patients hospitalized for HF**.**

FP was used as an instrument including five domains including weight loss, exhaustion, walking speed, physical activity and HGS. They found that the mean age was 80 ± 6 years and 49.6% were female including Frail: 70% patients.

Uchmanowicz et al. (2015)[96] did an observational study to evaluate the correlation between frailty and self-care abilities in HF patients including 110 participants Inpatients. Tilburg Frailty Indicator was used as an instrument.

Domains used were socio-demographic characteristics and potential determinants of frailty collected by clinicians and 15 self-reported questions divided into three domains: physical, psychological and social. They found that the mean age of cohort was 66 ± 11 years including 54% female. Frail and not-frail were 76% and 25% respectively. Longer duration of HF correlated with increased frailty.

MATERIAL AND METHODS

- This prospective study was conducted at Hero DMC heart institute, Ludhiana from May'18 to Sep'19 including 229 patients with the aim to assess the role of handgrip strength as a predictor of prognosis in heart failure patients and to know the prevalence of frailty in chronic heart failure (CHF) patients being managed with medical therapy and on regular follow-up along with the correlation of frailty phenotype with prognosis in the patients with CHF.
- The study included adult male and female CHF patients arriving in the OPD of the Hero DMC Heart institute ,Ludhiana ,Punjab
- Prior informed and written consent by the participants/patients were taken after explaining them the study in detail. Handgrip strength of the patients was measured by a standardized hand dynamometer in kilograms.
- Patient were asked to squeeze the dynamometer with his/her dominant hand and forearm strength for 5 seconds. This was repeated three times in each arm and the score was recorded.

Handgrip scores was obtained at entry level in the study. Patients were classified as having weak grip strength if their maximal value obtained was below the gender-derived and body mass index-derived cut-offs according to the Fried criteria[24].

- Baseline echocardiography was also done at entry level of all the patients for assessing the cardiac functions and baseline Left ventricular ejection fraction was noted down.
- All patients included in the study attending the OPD were examined thoroughly and baseline biochemical investigations were noted.
- Patients' biochemical parameters were recorded along with echocardiography and they were followed at 3 month, 6 month and 1 year.

Inclusion Criteria

- All consecutive patients with a diagnosis of chronic heart failure on medical therapy for at least 6 months,
- Age > 40 years,
- With the left ventricular ejection fraction less than 40 % at the time of enrolment and,
- Willing to participate in the study were included.

Exclusion Criteria

- Neuromuscular disorder where handgrip cannot be assessed were excluded from the study
- Patients not willing to give an informed consent

The study was approved by the institutional ethics committee.

All patients were asked a simple frailty questionnaire as given by **Fried et al.** and were divided into following groups-

1. Non-frail (participant without any of the five components of the questionnaire)
2. Pre- Frail and (participant with any of the one or two components of the questionnaire)
3. Frail (participant with any of the three or more components of the questionnaire)

- **The primary end point measured at the end of 1 year was**
  - cardiovascular mortality
  - re-hospitalization up to one year and
- All patients were followed up at the cardiac out-patient dispensary of the institute.

The handgrip dynamometer used in the study

Criterion	Frailty Status
Shrinking	**Frailty cut point:** **Baseline:** Self reported unintentional weight loss ≥10lb in previous year **Follow-up:** Unintentional weight loss ≥5% of previous year's body weight *OR* BMI <18.5kg/m^2
Physical endurance/energy	*Geriatric Depression Scale:* 1. *Do you feel full of energy?* 2. *During the last 4 weeks how often you rested in bed during day?* Response options: Every day, every week, once, not at all. **Frailty cut point:** No to 1 and every day or every week to 2.
Low physical activity	*Frequency of mildly energetic, moderately energetic and very energetic physical activity.* Response options: ≥3 times per week, 1-2 times per week, 1-3 times per month, hardly ever/never **Frailty cut point:** Hardly ever/never for very energetic physical activity AND for moderately energetic physical activity.
Weakness	Hand grip strength in Kg: GRIP-D hand held dynamometer, dominant hand, average of 3 measures. **Frailty cut point:** **Grip strength:** lowest 20% (by gender, body mass index) *Men* BMI ≤24 ≤29 BMI 24.1–26 ≤30 BMI 26.1–28 ≤30 BMI >28 ≤32 *Women* BMI ≤23 ≤17 BMI 23.1–26 ≤17.3 BMI 26.1–29 ≤18 BMI >29 ≤21
Slow walking speed	Walking time in seconds (usual pace) over 15 feet **Frailty cut point:** Slowest 20%, stratified by gender and median standing height. *Men* Height ≤173 cm ≥7 seconds Height >173 cm ≥6 seconds *Women* Height ≤159 cm ≥7 seconds Height >159 cm ≥6 seconds *OR* Time to complete "timed up and go test" (TUG) **Frailty cut point:** TUG time ≥19 seconds

Frail: ≥3 criteria present; **Intermediate or Pre-Frail:**1 or 2 criteria present; **Robust** : 0 criteria present

Adapted from Fried et al, Cardiovascular Health Study Collaborative Research G. Frailty in older adults: E for a phenotype. The Journals of Gerontology. Series A, Biological sciences and medical s 2001;56:M146-156.

Fried frailty questionnaire parameters used in the study

OBSERVATION AND RESULTS

This was a hospital based study done in total of 229 patients from the period of May 2018 to September 2019 with the aim of assessment of handgrip strength as a predictor of prognosis in patients of congestive heart failure in OPD of Hero DMC Heart Institute, Ludhiana, Punjab.

Table 1: Baseline characteristics of the patients

	Mean ± SD
Age(years) ± SD	60.52± 11.34
Height(cm)± SD	150±5.0
Sex(M/F)	2.09:1
BMI(Kg/m2)	24.4±2.13
Diabetics (n,%)	96(42)
Hypertension (n,%)	105(46.9)
Coronary artery disease(n,%)	169(73%)
Smoker	54(23.6)
LVEF(%) ± SD	29.88± 5.68
Creatinine(mg/dl) ± SD	1.33±1.23
Beta blockers(n, %)	97(42.4)
Diuretics(n, %)	212(92.6)
ACE I/ARB(n, %)	172(75.6)
Hemoglobin(g/dl)	12.16± 1.89
BNP (pg/ml)	729.1±815.4

Table 1 shows the baseline characteristics of the patients enrolled in the study. The patients enrolled were above 40 years of age with a range including 41 to 91 years of age and a mean of 60.5 years. The minimum height of the patient enrolled was 150 cm and the maximum was 178 cm.

The male to female ratio in the study population was 2.09:1, with 155

males and 74 females. The patients with a history of coronary artery disease constituted 73% of the study population. The percent of diabetics was 42% and the hypertensive patients were 46.9% of the study population.

The baseline ejection fraction of the study population was 29.88 (SD=5.68). 97 patients (42.4%) were on beta blocker therapy and 75.6% of the patients were on ACE inhibitors/ARBs. The minimum BMI among the patient enrolled was 19 and the maximum was 34 kg/m^2 with a mean of 24 kg/m^2.

Table 2: Distribution of the Age among total cases evaluated.

Age group	No. of cases	Percentage
< 50	35	15.3%
50-75	173	75.5%
>75	21	9.2%
Total	229	100.0%

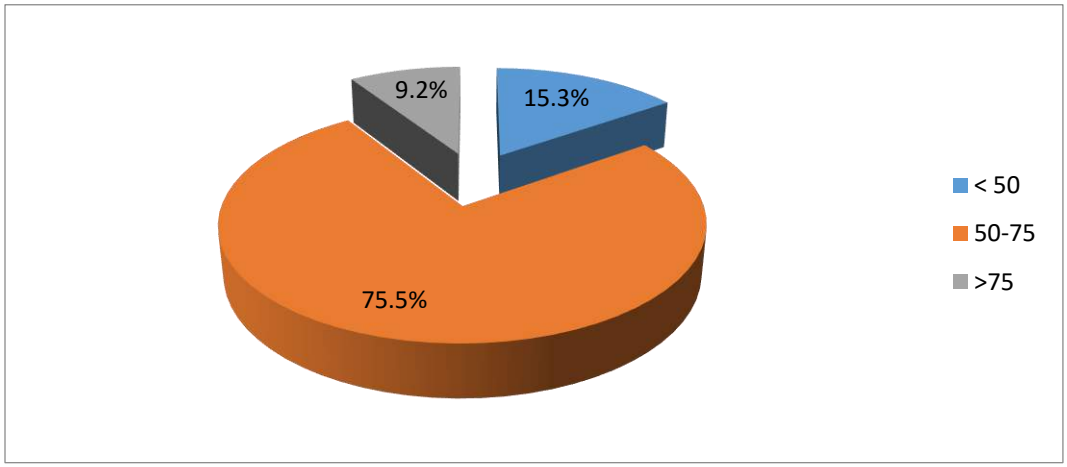

Figure 1: Distribution of patients in different age groups

Table no. 2 and figure 1 shows the age range of patients which was from minimum age being 40 years to maximum age 92 years with a mean age of 60.52 years. In the age group of 40-50 years 35 (15.3%) cases were tested out of which 23 (71.9%) cases were pre-frail and non-frail whereas were 9 (28.1%) frail patients.

The maximum number of patients were in between 50-75 years of age, total 173 (75.5%) cases were enrolled out of which 93 (57.1%) cases were pre-frail and non-frail whereas were 70 (42.9%) frail patients.

Similarly, from the age group of more than 75 years of age out of total 21 (9.2%) cases tested, 3 (14.3%) cases were pre-frail and non-frail whereas were 18 (85.7%) frail patients.

Table 3: Gender distribution among total cases evaluated

SEX	Total/no. of frail	Percentage
F	74/34	32.3%
M	155/63	67.7%
Total	229/97	100.0%

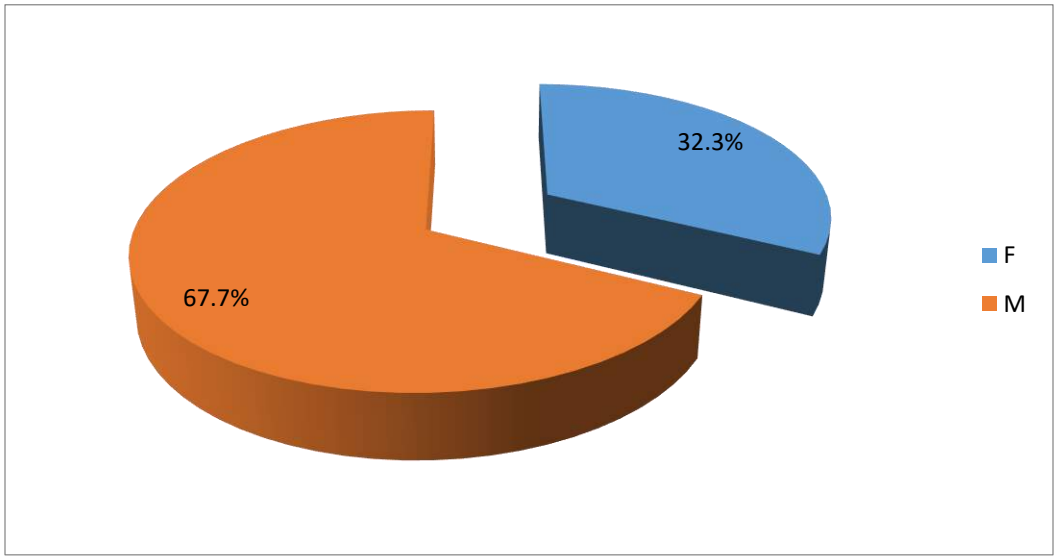

Figure 2: Gender distribution among total cases evaluated for frailty.

Table no.3 and fig. 2 shows the sex wise distribution of the cases. Of the 229 patients enrolled, 156(68.1%) were males and 73(31.9%) were females. Amongst non-frail and pre- frail cases, 82 were males (56.6.9%) and females being 37(52.1%). Similarly, of frail cases, 63 were males (43.4%) and 34(47.9%) were females. Therefore male predominance was seen both in the total samples evaluated and the patient strata that was positive for frailty.

Table 4: Distribution of total cases evaluated for the presence of Frality

Frailty type	No. of cases	Percentage
Non-Frail	6	2.8%
Pre-Frail	113	52.3%
Frail	97	44.9%
Total	216	100.0%

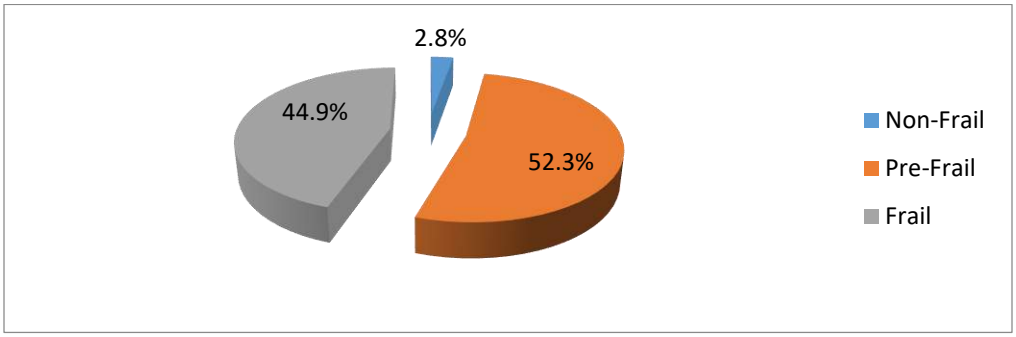

Figure 3: Distribution of total cases evaluated for the presence of Frailty

Table no.4 and fig.3 shows distribution of the total cases according to the frailty scores evaluated. Out of the total of 229 patients enrolled, 13 patients were lost to follow up. A total number of 216 patients and divided into non-frail, pre-frail and frail according to the simple frailty questionnaire as given by Fried et al. Participant with any of the three or more components of the questionnaire was considered as frail. Frail patients comprised 44.9% of the total patients and pre-frail patients were 52.3%. Non-frail patients constituted 2.8% of the patients.

Table 5: Associated comorbidities among the patients enrolled.

	No. of cases	**Percentage**
Coronary Artery Disease(CAD)	169	73.8%
Chronic liver disease(CLD)	1	0.4%
Diabetes(DM)	98	42.8%
Hypertension(HTN)	107	46.7%
Bronchial Asthma(BA)	3	1.3%
Chronic kidney disease(CKD)	9	3.9%
Tuberculosis(TB)	2	0.9%
Thyroid disease	4	1.7%
Pulmonary disease	17	7.4%

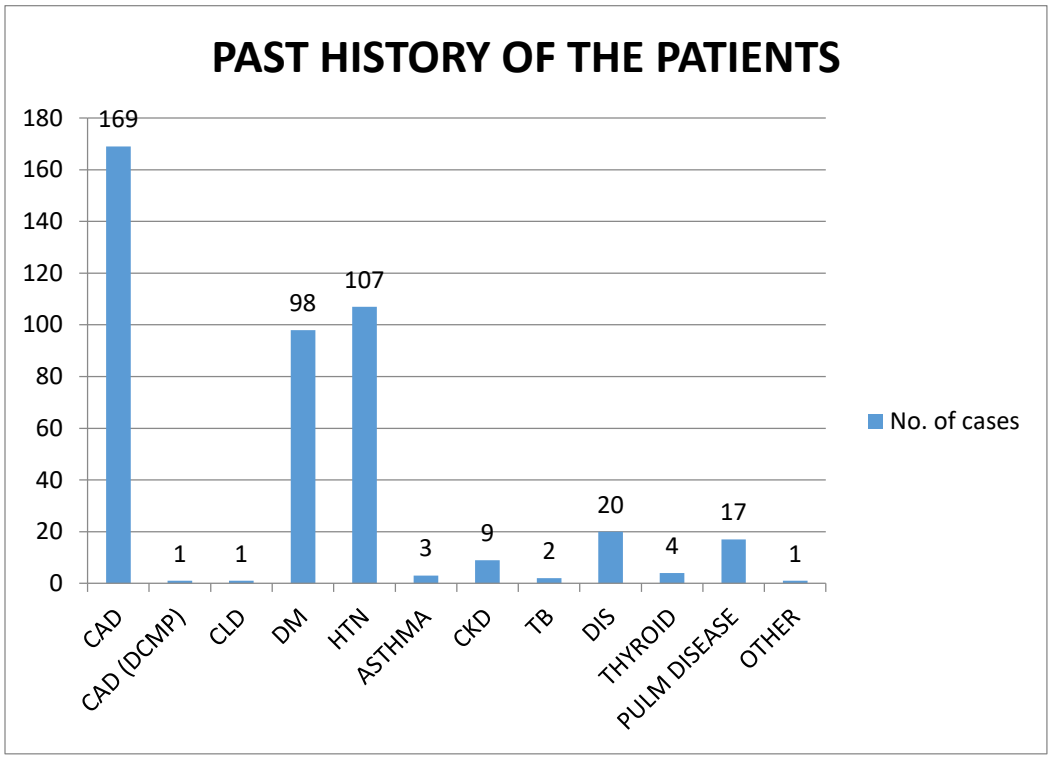

Figure 4.Distribution of various comorbidities among the patients enrolled.

Table 5 shows the distribution of different co-morbidities that were observed in the enrolled patients. The majority of the cases presented with coronary artery disease (CAD) (81.25%) followed by hypertension 107 (46.7%) and diabetes mellitus 98(42.8%). Chronic liver disease comprised of 1 (0.4%) case. Pulmonary disease patients were 17 (7.4%), bronchial asthma 3 (1.3%) and tuberculosis 2(0.9%). Chronic kidney disease and thyroid disease accounted for 9(3.9%) and 4(1.7%) respectively.

Table 6: Distribution of Frailty scores among the cases enrolled.

FRAILTY	No. of cases	Percentage
0	6	2.8%
1	48	22.2%
2	65	30.1%
3	64	29.6%
4	33	15.3%
Total	216	100.0%

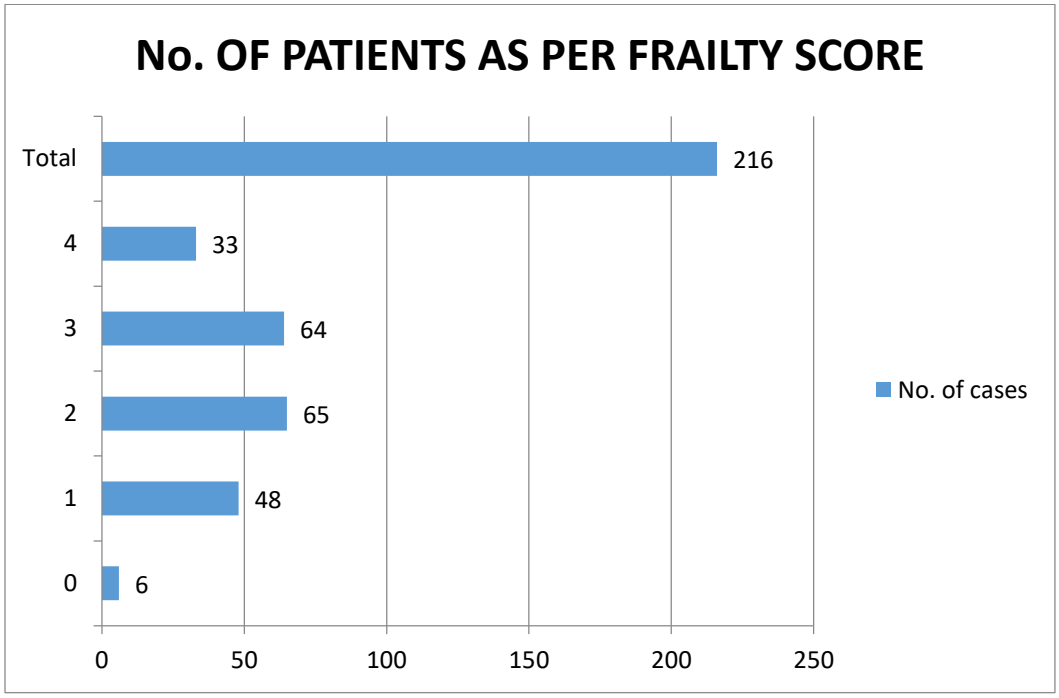

Figure 5: Distribution of Frailty scores among the cases enrolled.

Patients were assigned into pre-frail, non-frail and frail groups according to Fried et al questionnaire. Non-frail group included participant without any of the five components of the questionnaire). Pre-frail patients included participant with any of the one or two components of the questionnaire whereas frail included the participant with any of the three or more components of the questionnaire.

Maximum number of the patients, 65, were seen with frailty score of 2 followed by the patients with a score of 3 which comprised of 64 patients.

Non-frail patients with frailty score zero were 6 and 48 patients were with a score of 1 whereas 33 patients had a score of 4. Therefore, the maximum number of patients were in the pre-frail group, comprising of a Fried frailty score of 1 and 2.

Table 7: Distribution of presenting complaints among the cases enrolled.

	No. of cases	Percentage
Abdominal (ABD)	16	7.0%
Anorexia	7	3.1%
Obstructive sleep apnea(OSA)	5	2.2%
Chest pain (CP)	45	19.7%
Palpitation (PAL)	15	6.6%
No complaint (NO)	57	24.9%
Swelling in legs (SL)	8	3.5%
Dyspnea (SOB)	120	52.4%
Recent Hospitalization	3	1.3%
Syncope	6	2.6%

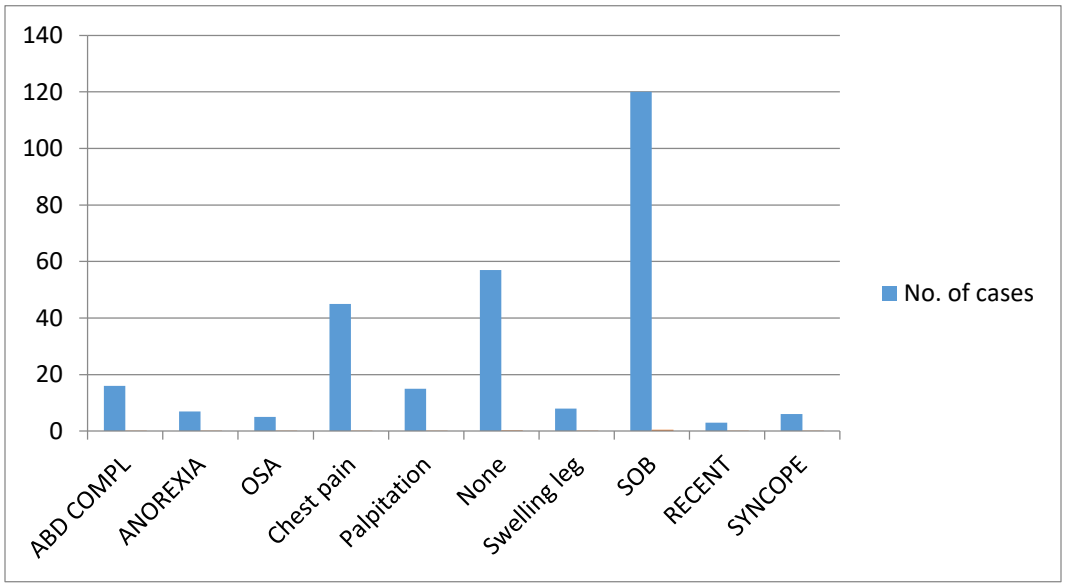

Figure 6: Distribution of associated complaints among the cases enrolled.

Table 7 and figure 6 show the distribution of the patients according to the presenting complaints at the time of enrolment in the study. Most common (52.4%) presenting complaint of the patients was dyspnea followed by

chest pain (19.7%). The patients who were asymptomatic at the presentation were 24.9%. 7% of the patients had abdominal complaints and 3.1% had anorexia at presentation. Thus, dyspnea constituted the predominant complaint of the patients of heart failure enrolled in the study.

Table 8: Distribution of drugs among the cases enrolled.

	No. of cases	**Percentage**
Beta Blockers	97	42.4%
ACE inhibitors/ ARBs	172	75.1%
diuretics	212	92.6%

Table 8 shows the patient distribution according to the drugs which the patients had been put on. The results showed that 42.4% of the patients were on beta blockers while diuretics were prescribed in 92.6% of the patients and ACEIs in 75% patients.

Table 9: Primary outcomes in the patient groups.

		Group				**Total**
		Non/Pre-frail (n=119)		**Frail** (n=97)		
Rehospitalisation/Mortality	N	107	66.9%	53	33.1%	160
	Y	12	21.4%	44	78.6%	56

Table 9 shows the outcomes in the frail group vs non frail/pre frail group. The outcome of rehospitalisation/ mortality was seen in 21.4% of the patients in non frail/pre frail group compared to 78.6% patients in frail group with a significant p value (<0.001).

Table 10: Difference in rate of rehospitalisation between two groups.

		Group				**Total**	**Chi-square Value**	**p-value**
		Non/Pre-frail (n=119)		**Frail** (n=97)				
Rehospitalisation	N	111	58.7%	78	41.3%	189	8.087	0.006
	Y	8	29.6%	19	70.4%	27		

Table 10 shows the difference in hospitalisation in the frail vs non/pre frail patients. The rehospitalisation rates in frail patients in this study was 70.4% as compared to 29.6% in non/pre frail patients with a significant value of 0.006.

Table 11: Difference in mortality between two groups.

		Group				Total	Chi-square value	p-value
		Non/Pre-frail (n=119)		Frail (n=97)				
Mortality	N	115	61.8%	71	38.2%	186	24.556	0.001
	Y	4	13.3%	26	86.7%	30		

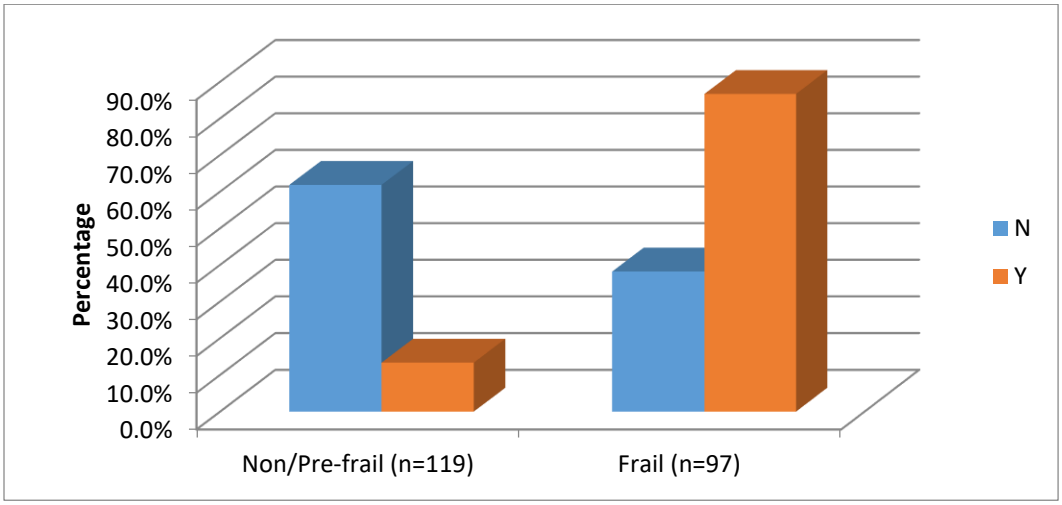

Figure 7: Showing difference in mortality in non/pre frail group vs frail group.

Table 11 shows mortality difference between frail and non frail patients. Mortality in frail patients in this study was 86.7% and 13.3% in non/pre frail patients with a p value =0.001. The mortality in the frail group was significantly higher than the non/ pre frail group.

Table 12: Showing difference in handgrip strength between frail and non/pre frail patients

	Non/Pre-frail		Frail		t	p-value	95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Lower	Upper
HAND GRIP	23.01	8.12	18.28	6.07	-4.755	0.001	-6.69	-2.77

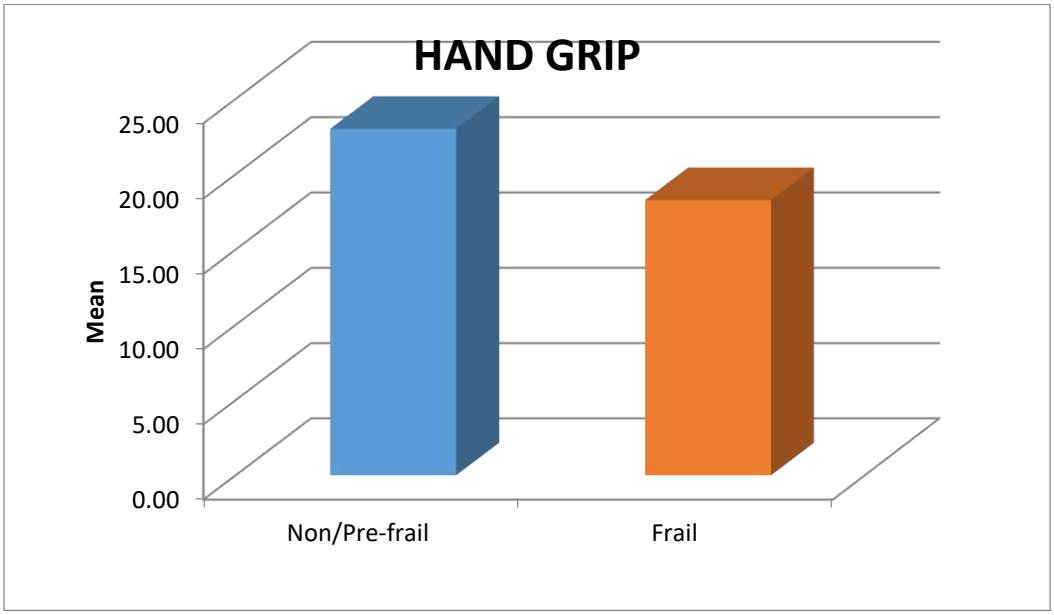

Figure 8: Handgrip strength in frail vs pre/non frail group

The handgrip strength was significantly different between the frail vs non/pre frail group. The mean handgrip strength in frail group was 18.28 compared to 23.01 in pre/non frail group. This is shown in the table 12.

Table 13: Correlation of handgrip strength and frailty score with EF and creatinine levels at baseline, 6 months and 12 months.

		EF	EF6	EF12	CREAT 0M	CREAT 6 MON	CREAT 12M
HAND GRIP	Pearson Correlation	0.027	0.133	0.135	-0.179	-0.150	-0.169
	p-value	0.687	0.065	0.068	0.007	0.027	0.021
FRAILTY SCORE	Pearson Correlation	-0.048	-0.252	-0.216	0.158	0.129	0.181
	p-value	0.484	0.001	0.004	0.021	0.065	0.016

The handgrip strength showed a negative correlation with creatinine levels and BNP of the patients enrolled in the study along with a positive correlation with the ejection fraction. This has been depicted in the tables 13 and 14. Handgrip had a pearson correlation coefficient of -0.179 with creatinine at enrolment and -0.199 with BNP levels at baseline.

Thus, the patients with a weaker handgrip had a higher creatinine levels and a lower ejection fraction as compared to the patients with a stronger handgrip strength. In a similar way, the patients who had a higher frailty score had a lower ejection fraction and higher creatinine levels at baseline, 6 months and 12 months of follow up.

Table 14: Correlation of handgrip and frailty score with BNP at enrolment, 6 months and 12 months.

		BNP 0M	BNP6M	BNP12M
HAND GRIP	Pearson Correlation	-0.199	-0.282	-0.202
	p-value	0.003	0.001	0.006
FRAILTY SCORE	Pearson Correlation	0.231	0.423	0.405
	p-value	0.001	0.001	0.001

The handgrip strength showed a negative correlation with the BNP levels at baseline, 6 months and 12 months. The patients having a weaker handgrip strength had higher BNP levels. Similarly, frailty score showed a positive correlation to the BNP levels. Patients having a higher frailty score showed a higher BNP level at baseline, 6 months and 12 months. This indicates that with an increase in BNP levels, the patients become increasingly frail and have a weaker handgrip strength. Frail patients have higher BNP levels and weaker handgrip strengths as shown in this table 14.

Table 15: Outcomes in different age groups of the patients

		Outcome				**Total**	**Chi-square value**	**p-value**
		Survival		Mortality				
Age group	<50	27	84.4%	5	15.6%	32	7.823	0.02
	50-75	145	89.0%	18	11.0%	163		
	>75	14	66.7%	7	33.3%	21		

Table 15 shows the outcomes in the different subsets of patients as per the age groups. Highest mortality was seen in the patients more than 75 years of age which was 33.3% compared to 11% in 50-75 years of age. Increasing age is an indicator of poor outcome in the patients with heart failure with reduced ejection fraction. Elderly age is itself a predisposing factor for frailty owing to the multiple physiologic changes associated with ageing.

Table 16: Showing correlation of baseline demographic characteristics with mortality.

	Survival		mortality		t	p-value	95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Lower	Upper
AGE	60.06	10.96	64.97	13.56	2.196	0.029	0.50	9.30
HEIGHT	168.03	4.59	167.60	6.31	-0.447	0.656	-2.31	1.46
WEIGHT	68.35	5.37	67.33	5.17	-0.972	0.332	-3.09	1.05
BMI(Kg/m)	24.22	1.83	24.04	2.24	-0.496	0.620	-0.92	0.55

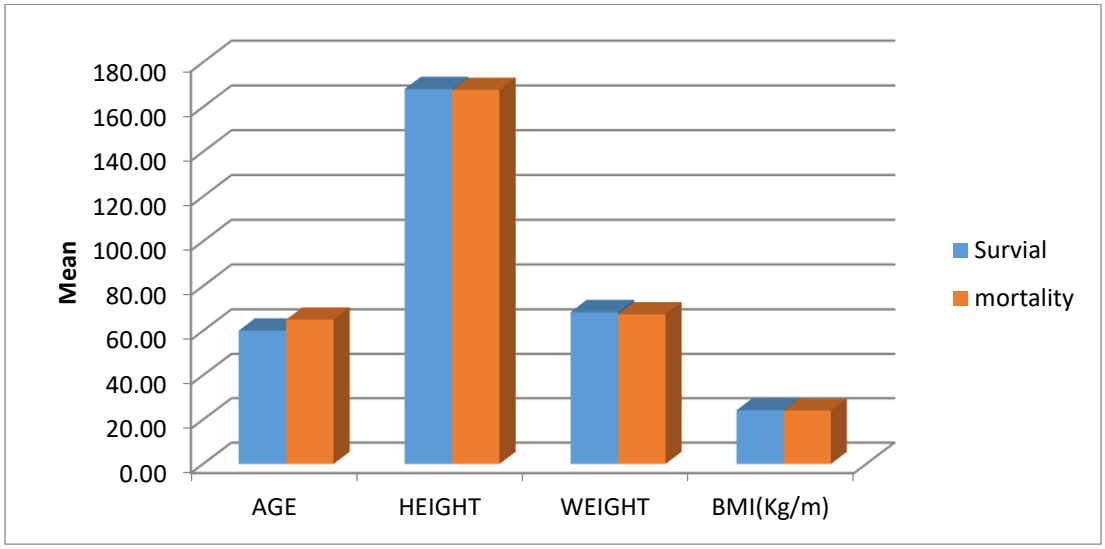

Figure 9: Demographic characteristics and the difference in mortality

There was no significant difference in the percentage of survivors and non survivors when the baseline characteristics of age, weight, height and BMI were compared. Therefore the parameters of height, weight and BMI were not significantly different in the survivors and non-survivor group. In this study the BMI showed no significant association with the patient outcomes. This is shown in table 16 and figure 9.

Table 17: Showing correlation of mortality with Ejection fraction in patients

	Survial		mortality		t	p-value	95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Lower	Upper
EF	29.99	5.76	29.47	5.67	-0.464	0.643	-2.75	1.70
EF6	31.60	5.15	28.00	4.59	-2.693	0.008	-6.23	-0.96
EF12	32.04	5.18	30.50	5.96	-0.712	0.477	-5.81	2.73

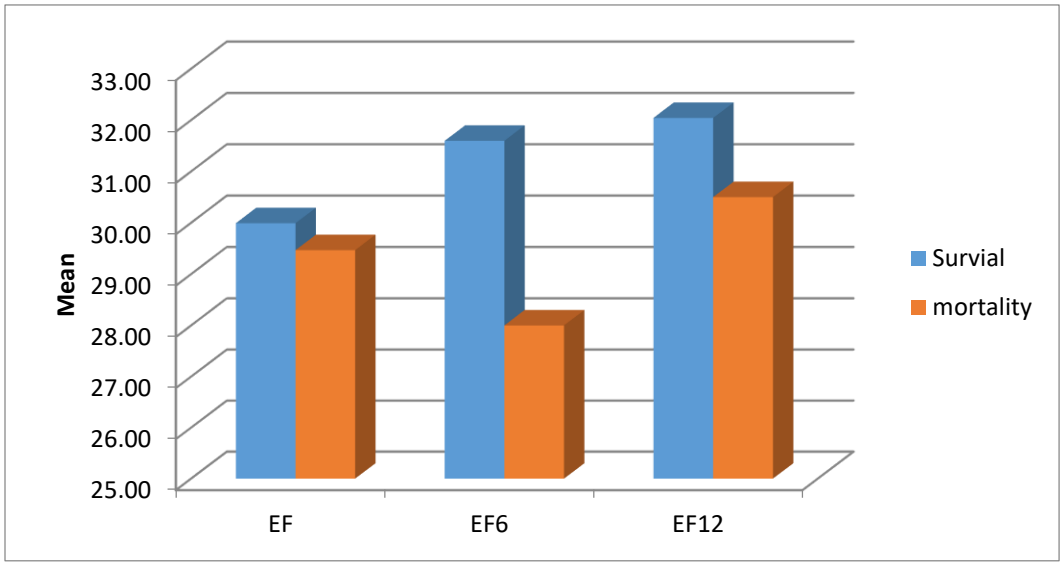

Figure 10: Correlation of EF with outcomes in survivor vs non survivor group

Ejection fraction showed a negative correlation with survival. The patients in the non-survivor group had a lower ejection fraction compared to the patients in the survivor group. The mean ejection fraction in the non-survivor group was 28%, SD 4.5 compared to 31.6%, SD 5.1 (p value=0.008). Table 17 shows the negative correlation of the ejection fraction between survivor and non-survivor group. A lower ejection fraction was associated with increased mortality risk in this study.

Table 18: Showing correlation of mortality with BNP of the patients

	Survival		Mortality		t	p-value	95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Lower	Upper
BNP 0M	631.09	751.78	1322.74	890.41	4.344	0.001	377.71	1005.59
BNP6M	244.86	259.53	711.31	351.60	6.642	0.001	327.88	605.03
BNP12M	175.45	185.70	231.17	200.39	0.720	0.472	-96.99	208.42

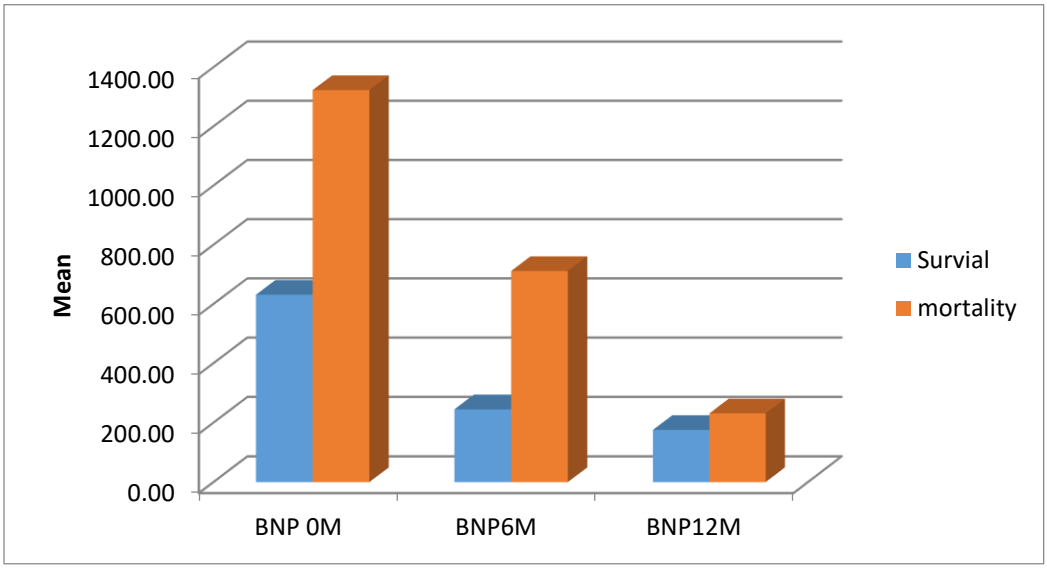

Figure 11: Correlation of BNP with mortality

BNP showed a positive correlation with mortality as shown in table 18. There was a significant difference in the mean BNP of the patients in survivor and non-survivor group at baseline and at 6 month follow up with a mean of 631 in survivor group at baseline vs 1322 in non-survivor group(value<0.001)

Table 19: Showing difference in handgrip strengths of survivor vs non survivor group.

	Survival		mortality		t	p-value	95% Confidence Interval of the Difference	
	Mean	SD	Mean	SD			Lower	Upper
Hand Grip	21.70	7.62	15.83	5.52	-4.052	0.000	-8.73	-3.02

Handgrip strength was significantly different in the survivors and non-survivor group. As shown in table 18, the mean handgrip strength in the survivors was 21.7(SD 7.6) and 15.8(SD 5.5) in non-survivor group (p value<.001).

Table 20: Univariate analysis of different parameters with outcomes.

UNIVARIATE ANALYSIS					
		Mortality		**Chi-square value**	**p-value**
		No	Yes		
Age group	< 50	27(84.4)	5(15.6)	7.823	0.02
	50-75	145(89)	18(11)		
	>75	14(7.7)	7(25.9)		
Sex	F	60(84.5)	11(15.5)	3.37	0.338
	M	126(86.9)	19(13.1)		
DRUGS BB		83(93.3)	6(6.7)	6.461	0.01
ACE I		149(92.5)	12(7.5)	21.896	0.001
Diuretics		173(86)	12(7.5)	0.004	0.949
Frailty type	Non-frail/ Pre-Frail	115(61.8)	4(13.3)	24.56	0.001
	Frail	71(38.3)	26(86.7)		
Re-hospitalisation	Y	13.7)	1(3.7)	2.151	0.143
BNP	Mean ± SD	631.09	1322.74	4.344	0.001
HAND GRIP	Mean ± SD	21.7±7.62	15.8±5.52	-4.052	0.001

Table 19 depicts the univariate analysis of the baseline features of the patients with the outcome of mortality. This has been shown in previous tables with individual baseline features. Increased age, increased baseline BNP, increased frailty and weak handgrip strength were associated with increased mortality in the study population. Use of beta blockers and ACE inhibitors/ARBs in the patients with CHF was significantly different in the survivors and non surviviors.

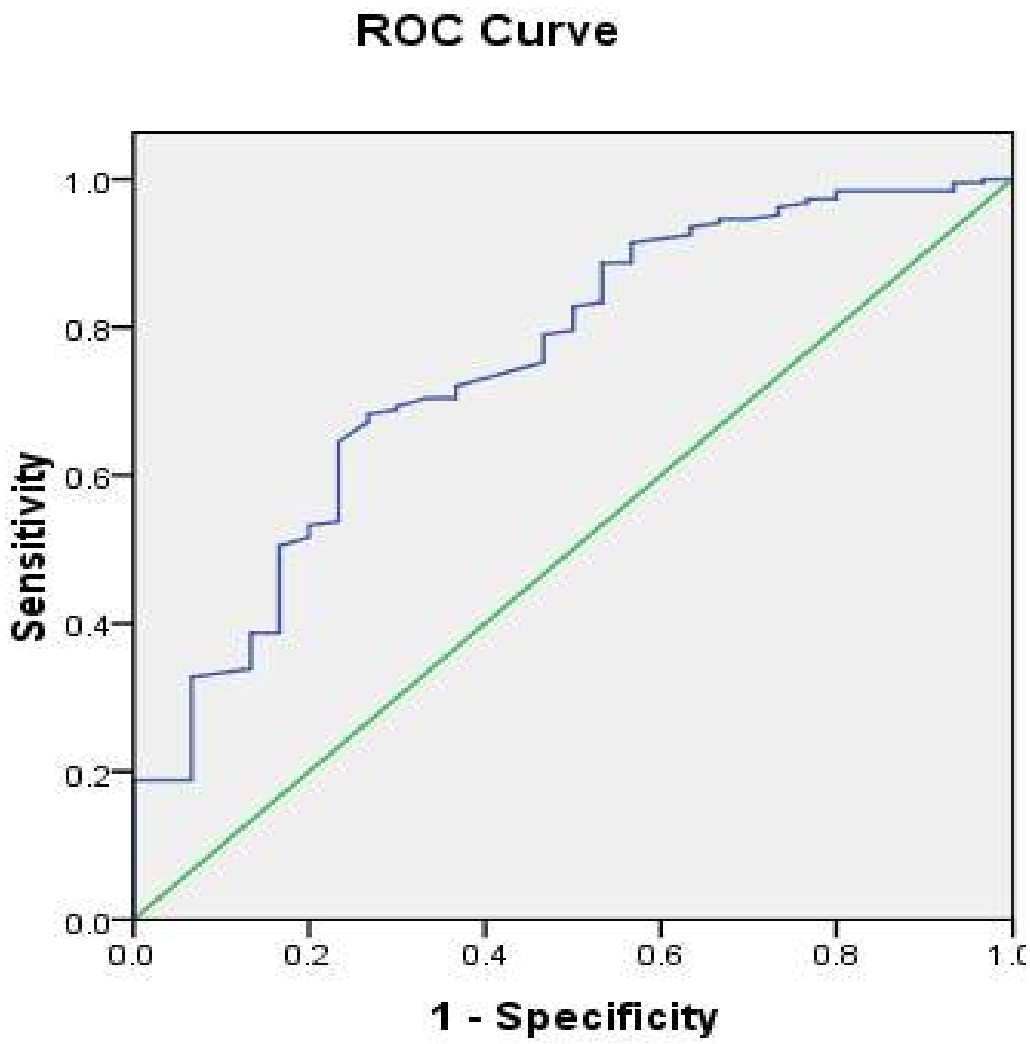

Figure 12: ROC curve of Handgrip strength in predicting survival.

Predictive accuracy of handgrip strength for prognosis is shown in the receiver- operating characteristic curve of hangrip strength to predict survival in patients with CHF (Area under the curve =0.75 with a p value=<0.001). Handgrip strength >16.95 kg had a sensitivity of 72% and specificity of 63% for the prediction of survival in the patients with heart failure.

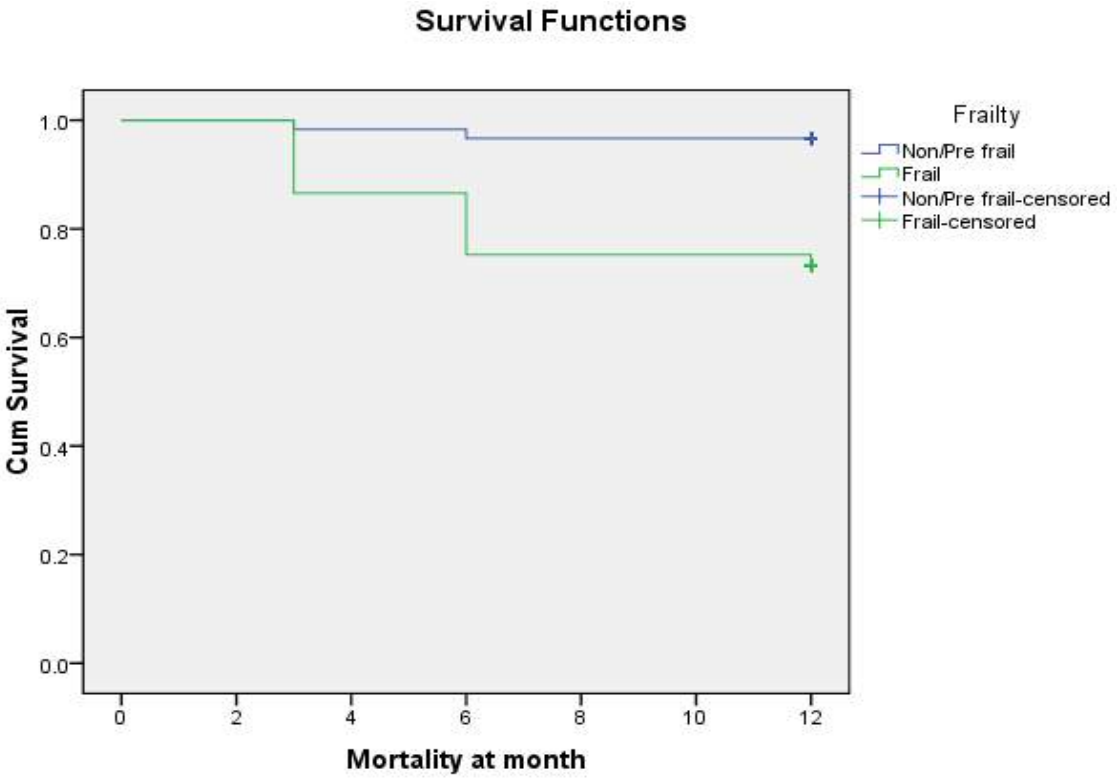

Figure 13: Kaplan Meier graph for survival in frail and non/pre frail patients.

The Kaplan meier graph shows the difference in the survival between frail and non/pre-frail patients. The survival was more in the non/pre-frail group at 1 year of follow up.

Table 21: Multivariate regression for predicting mortality with age/BNP/Handgrip

	Odds ratio	**95% C.I.for EXP(B)**		**p-value**
		Lower	Upper	
AGE	1.005	0.963	1.048	0.822
BNP	1.001	1.000	1.001	0.006
HANDGRIP	0.846	0.768	0.932	0.001
EF	0.994	0.916	1.079	0.884

Table no 20 shows the multivariate regression analysis for predicting mortality in patients with respect to age, BNP and handgrip strength showed an odd's ratio of 1.001 for BNP and 0.846 for handgrip with a significant p value =0.001 for handgrip strength.

DISCUSSION

To the best of our knowledge, this is the first of its kind study in the country, studying frailty and the prognostic value of handgrip strength in the patients with heart failure.

Our study shows that handgrip as a component of frailty is a predictor of adverse outcomes in the patients with CHF. This study sought to evaluate the utility of handgrip strength, an individual component of frailty scales, as a screening marker of prognosis in patients with CHF.

This study used the definition of frailty as defined by Fried et al[24].

The study provides added insight into the implications of frail phenotype on the patients with heart failure with reduced ejection fraction. Our study also allows to view frailty as an entity which is to be distinguished from ageing, and to view ageing in the chronologic versus biologic terms. This concept can be made use of when planning the treatment strategy of the patients with CHF with reduced ejection fraction.

The cardiovascular mortality in the patients with CHF has been linked to ejection fraction, BNP and BMI previously. Our study is in line with the previous data and has resulted in the outcomes of increased mortality in the heart failure patients with lower ejection fraction and raised BNP levels.

The previous studies for the assessment of outcomes in patients with CHF having frailty have had the prevalence of frailty ranging from 18% to 40%. These studies have mostly assessed the elderly population with a mean age above 65. Altimir et al[45] found a frailty prevalence of 42%, Boxer et al[77] 27%, Cacciatore et al[86] 54%, McNallan et al[44] 21% in the patients of CHF.

Comparison of various studies undertaken for the assessment of impact of frailty on outcomes in CHF patients.

Source (First Author)	Year	Country	Study Period	Design	Type of Patients	Frailty Assessment	No of Patients	Age, Mean± SD,y	Men, n (%)	Prevalence of Frality, % (n/Total)	Hazard of Death/ Hospitalization
Parmar	2015	UK	N/A	Retrospective	Patients with HF, aged>75 y	CSHA	261	N/A	N/A	75.6(197/261)	1.5
Rodriguez-Pascual	2017	Spain	2010-2012	Prospective	Patients with HF, aged ≥75 y, who had at least one hospitalization in the past 12 months	Fried phenotype	497	85.2±7.3	194(39)	57.5(286/497)	1.5
Alfmir	2005	Spain	2001	Prospective	Outpatients with HF	CGA	360	65.2±10.9	261(72.5)	41.7(150/360)	1.5
Boxer	2008	USA	N/A	Prospective	Outpatients with HF, aged ≥ 60 year	Fried phenotype	60	77±10	43(71.7)	25(15/60)	1.5
Gastelurrutia	2013	Spain	2001-2012	Prospective	Outpatients with HF	CGA	1405	66.7±12.4	1015(72.2)	44.2(621/1405)	1.5
Kenny	2006	USA	N/A	Prospective	Patients with HF, aged ≥ 60 year	Fried phenotype	59	Men, 76±9, women, 78±12	41(71.7)	27.6(16/59)	1.5
Lupon	2008	Spain	N/A	Prospective	Outpatients with HF	CGA	622	68(median)	451(72.5)	39.9(248/622)	1.5
Pans	2010	Spain	2001-2008	Prospective	Outpatients and Inpatients with HF	CGA	960	69	681(70.9)	35.1(337/960)	1.5
Our Study	2019	India	2017-2018	Prospective	Outpatients with LVEF<40	Fried phenotype	229	60±11.3	156(68.1)	44.3(93/229)	4.5

Table 21 shows a comparison of various studies done in the recent years in the patients with CHF assessing the prevalence of frailty and the outcomes in frail patients. Our study finding of increased frailty in the CHF patients is in line with the previous studies done mainly in the USA, UK and Spain. These studies have been done mostly in the elderly population with a mean age above 66 years of age. Our study had a mean age of 60 years and included a younger population as compared to the other studies. The majority of studies resulted in a hazard ratio of 1.5 for the endpoint of hospitalisation or mortality. Our study had a significantly higher hazard ratio of 4.5 for hospitalization or mortality. This might point out towards a higher frailty in the Indian patients with CHF with a higher risk of mortality and rehospitalisation. Our study also suggests that frailty is also prevalent in younger CHF patients and not only in the elderly population. This comparatively younger subset of the patients with CHF might benefit more with timely identification of frailty and intensification of the guideline directed therapy with periodic follow up.

Despite being much prevalent in the CHF patients, there have been few RCTs including this strata of patients. Frailty is associated with increased morbidity and mortality but this has also been not documented by many studies involving CHF population.

Pulignano et al[66] reported increased hospitalisation in the patients with CHF (20.55 vs 13.3%). In our study, frail patients had a significantly higher hospitalisation rates as compared to non-frail/pre-frail patients (70.4% vs 29.6%).

There have been a limited number of studies assessing the impact of frailty on mortality. Cacciatore et al[86] assessed the predictive role of frailty in long-term (12 years) mortality in patients with (n = 120) and without CHF (n = 1139). In this study, frailty was independently associated with increasing mortality risk in both the CHF and non-CHF populations, with frailty being a stronger predictor of mortality in those with CHF. During the 12-year follow-up period, 0 % of the CHF patients with severe frailty (stage 3) survived past 9 years, compared with 45 % with mild frailty (stage 1).

Similar results were identified in the study by Lupon et al[33] of 622 CHF outpatients, where frailty was an independent predictor of 1-year mortality, even after adjustment for known CHF correlates.

In our study, Mortality was seen in 86.7% frail patients as compared to 13.3 % non/pre-frail patients (p value <0.001). The end point of rehospitalisation was also significantly higher in the frail patients (70.4 vs 29.6%, p value =0.006). Recent study by McNallan et al[44,93] also identified a two fold increase in the mortality in frail patients of CHF in a study of 223 patients.

An important outcome of our study was the significant correlation of the handgrip strength with mortality at one year of follow up of the patients. The mean handgrip strength in survivor patient group was 21.70(SD 7.6) and 15.8(SD 5.5) in the non-survivor group (p value <0.001). A handgrip strength of >16.8 kg had a 72% sensitivity and 63% specificity in predicting survival. The mean handgrip strength assessed in the frail patients was 18.28 kg and 23.01 kg in non/pre-frail patients. This finding of significant difference in the handgrip strength of the frail and non/pre-frail patients has its implications in the use of handgrip strength as a screening tool for prediction of prognosis in the patients with heart failure with reduced ejection fraction.

Multivariate regression analysis for predicting mortality in patients with respect to age, BNP and handgrip strength showed an odd's ratio of 1.001 for BNP and 0.846 for handgrip with a significant p value =0.001 for handgrip strength. Elderly age, raised BNP and weak handgrip strength were associated with poor survival in the patients enrolled in the study. BNP has been previously shown to be a marker of poor prognosis in patients with heart failure[100]. The mean BNP level of our patients who were non survivors was 1322.74, SD 890.

There was no significant difference in height, weight and BMI of the survival and non-survival groups. Although BMI should be lowered in the patients with heart failure and obesity impairs the ventricular functions furthermore in the patients with heart failure, our study did not find a significant difference in the BMI of the patients in the survivor and non-survivor group. Davos et al[101] have suggested

that a lower BMI and cachexia is an indicator of poor prognosis in the heart failure patients. However, our study found no relation of BMI with the mortality.

The use of beta blockers and ACE inhibitors/ARBs was significantly different in the frail and non/pre frail group. 6.4% of the non-survivor patients were on beta blockers as compared to 93.3% of the survivors. ACE inhibitors were used in 92.5% of the survivors as compared to 7.5% of the non survivors. This has important implications for the treatment strategy of the patients with CHF, and is in line with the guidelines for the use of beta blockers and ACE inhibitors/ARBs for the mortality reduction in the CHF patients.

Elderly age was a predictor of poor prognosis in this study. Mean age between non survivor and survivor group was significant (64.97±13.5 vs 60.06±10.96, p value =0.02).

Haemoglobin and creatinine levels were significantly different in the survivor vs non survivor group (Hb 12.3±1.36 vs 11.15±1.9; p value=0.001) (Creatinine 1.21, SD 1.01 vs 2.01, SD 1.95; p value=0.001) (BNP 631, SD 751 vs 1322.74, SD 890.4; p value<0.001). The Hb levels were lower in the patients who were frail and lower haemoglobin level was an indicator of mortality in the study population. Creatinine also showed a positive correlation with mortality in our study with a mean creatinine of 1.21, SD 1.01 in survivors and a mean of 2.01, SD 1.95, in non survivors. There was also a significant difference between the creatinine levels of frail and non/ pre-frail patients.

In this study, among the patients with CHF who were frail, percentage of female were more as compared to the males (47% vs 43.4%), however, the difference was not significant. In the overall study population, the number of males were more than the females (67.7% vs 32.3%). There was also no significant difference between the mortality in males as compared to females (13.1% vs 15.5%). Thus, sex had no relation to mortality in our study.

Handgrip strength was found by multivariate analysis to be a predictor of mortality in patients with CHF. Most importantly, handgrip strength was lower in the nonsurvivor group than in the survivor group, indicating that this variable may affect prognosis in CHF patients.

The association of weak handgrip with poor prognosis can be explained by multiple pathophysiologic mechanisms. Patients with CHF have reduced muscle mass and decreased type I (oxidative) muscle fibers, capillary density, and oxidative enzymatic activity, and an increased percentage of type II fibers, mainly as a result of an increase in type II b fibers[102]. The knee flexor muscles are mainly composed of type I fiber antigravity muscles, whereas knee extensor muscles are composed of type II fibers[103]. These findings may indicate that the percentage of type I fibers is reduced as CHF severity increases. Therefore, a reduction in the oxygen carrying capacity by the type 1 fibers initially might be compensated by an increase in the number of fibers but at a later stage, fails to compensate for the decreased capacity.

Patients with CHF have difficulties in performing the daily routine activities, which utilize the upper extremities preferably compared to the lower extremity[104].

Buller et al[105] suggested that patients with CHF show both atrophy and weakness of large locomotive muscles with increased fatigue that correlates with the severity of CHF. Handgrip strength may be representative of overall muscular strength as it correlates well with other muscular strength measures.

Thus, CHF reduces the muscle mass in the antigravity and non-antigravity muscle groups and the handgrip strength may be indicative of the overall muscle weakness and generalized sarcopenia in the CHF patients. Weak handgrip strength may therefore be an indicator of poor prognosis in the patients with CHF.

Hence our study shows that handgrip is a predictor of major adverse cardiological events (rehospitalisation/ mortality) in patients with heart failure and reduced ejection fraction.

Limitations of the study

1. This was a single centre study
2. It had a non-randomized design
3. Bias due to difference in optimal medical therapy cannot be ruled out.

SUMMARY AND CONCLUSION

1. Handgrip strength is related to the prognosis in the patients with congestive heart failure with weak handgrip strength associated with poor survival and increased hospitalization rates.
2. Handgrip strength measurement at follow up visits may be useful to assess the outcomes in the heart failure patients who have been undergoing exercise training and rehabilitation
3. Frailty, as measured by handgrip strength is prevalent even in the younger age group.
4. There is a significant underuse of the drugs with mortality benefits, like beta blockers and ACE inhibitors, in the frail patients with CHF.
5. CHF population with frailty has a higher mortality as compared to the non-frail/pre-frail population.

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-	MRD	NAME	SEX	AGE	HEIGHT	WEIGHT	BMI(Kg/m)	COMPLAINTS	ABD	ANOREX	OSA	CP	PAL	NO	SL	SOB	RECENT	SYNCOPE	PAST HISTORY	CAD	CAD (DCMP	CLD	DM	HTN	BA	CRD	TB	DIS	THYROID	PULDIS	OTHER
1	94640	s	M	63	174	76	25.10	NO	N	N	N	N	N	Y	N	N	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N
2	168301	m	M	59	172	65	21.97	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
3	162410	k	M	63	174	68	22.46	SL , ABD	Y	N	N	N	N	N	Y	N	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
4	316540	p	M	65	168	70	24.80	SOB , OSA	N	N	Y	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
5	37607	a	M	50	169	65	22.76	ANOREX , OSA	N	Y	Y	N	N	Y	N	N	N	N	HTN , CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
6	108453	v	M	60	167	80	28.69	NO	N	N	N	N	N	Y	N	N	N	N	HTN , CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
7	109469	g	M	73	170	62	21.45	NO	N	N	N	N	N	Y	N	N	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
8	246958	d	M	68	170	67	23.18	SOB	N	N	N	N	N	N	N	Y	N	N	HTN , CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
9	67772	isha	F	47	156	67	27.53	SOB	N	N	N	N	N	N	N	Y	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
10	229418	h	M	46	170	70	24.22	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
11	155563	mk	F	51	165	76	27.92	SOB,CP,PAL	N	N	N	Y	Y	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
12	159541	s	F	68	160	58	22.66	NO	N	N	N	N	N	Y	N	N	N	N	HTN, CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
13	157018	k	M	53	171	82	28.04	SL	N	N	N	N	N	N	Y	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
14	161360	ds	M	60	160	88	34.38	SOB , CP, SL	N	N	N	Y	N	N	Y	Y	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
15	161141	s	F	80	162	56	21.34	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
16	161144	j	M	53	167	74	26.53	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
17	158597	a	M	55	168	70	24.80	SOB	N	N	N	N	N	N	N	Y	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
18	158396	s	M	69	171	65	22.23	SOB, SL	N	N	N	N	N	N	Y	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
19	144588	u	F	58	164	73	27.14	SOB, PAL	N	N	N	N	Y	N	N	Y	N	N	HTN, CAD,BA	Y	N	N	N	Y	Y	N	N	N	N	N	N
20	515543	**tara sing**	**M**	40	170	83	28.72	NO	N	N	N	N	N	Y	N	N	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
21	159890	g	M	60	168	70	24.80	SOB	N	N	N	N	N	N	N	Y	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
22	152413	k	F	64	158	67	26.84	NO	N	N	N	N	N	Y	N	N	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
23	148081	m	M	81	174	58	19.16	SOB, CP, RECENT	N	N	N	Y	N	N	N	Y	Y	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
24	99689	k	M	65	172	73	24.68	SOB, ABD	Y	N	N	N	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
25	168273	j	M	57	174	75	24.77	SOB, ABD	Y	N	N	N	N	N	N	Y	N	N	HTN, CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
26	116212	p	M	41	172	73	24.68	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
27	160939	k	M	65	168	67	23.74	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD,TB, HCV	Y	N	N	N	Y	N	N	Y	N	N	N	N
28	161471	s	F	59	152	70	30.30	SOB	N	N	N	N	N	N	N	Y	N	N	HTN, CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
29	163456	a	M	63	178	92	29.04	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
30	166889	s	M	52	167	70	25.10	ABD	Y	N	N	N	N	N	N	N	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
31	153156	a	M	65	170	72	24.91	SOB	N	N	N	N	N	N	N	Y	N	N	HTN ,DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
32	96914	r	M	40	171	74	25.31	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
33	165877	s	M	76	172	74	25.01	SOB, ABD	Y	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
34	156946	k	F	41	166	73	26.49	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
35	66375	j	M	38	174	80	26.42	PAL	N	N	N	N	Y	N	N	N	N	N	HTN, CRD, CAD	Y	N	N	N	Y	N	Y	N	N	N	N	N
36	31115	b	M	67	164	76	28.26	SOB, ABD	Y	N	N	N	N	N	N	Y	N	N	HTN, HTN, BA	N	N	N	N	Y	Y	N	N	N	N	N	N
37	156139	r	M	46	168	76	26.93	ABD	Y	N	N	N	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
38	165825	b	M	64	176	73	23.57	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
39	146880	j	M	66	168	64	22.68	ABD	Y	N	N	N	N	N	N	N	N	N	HTN, DM,CRD,CAD	Y	N	N	Y	Y	N	Y	N	N	N	N	N
40	335452	mk	F	55	166	80	29.03	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,CLD	Y	N	Y	N	N	N	N	N	N	N	N	N
41	420609	h	M	51	171	65	22.23	NO	N	N	N	N	N	Y	N	N	N	N	HTN, CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
42	524184	j	F	61	175	85	27.76	NO	N	N	N	N	N	Y	N	N	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
43	-	k	M	75	161	81	31.25	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
44	149483	r	M	71	171	60	20.52	PAL,SL,OSA	N	N	Y	N	Y	N	Y	N	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
45	527708	s	M	61	167	68	24.38	NO	N	N	N	N	N	Y	N	N	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
46	159890	g	M	58	168	70	24.80	NO	N	N	N	N	N	Y	N	N	N	N	DM, CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
47	529289	cr	M	55	175	83	27.10	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
48	496790	a	M	72	170	62	21.45	ABD	Y	N	N	N	N	N	N	N	N	N	HTN, DM, CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
49	528382	p	M	62	168	64	22.68	SOB	N	N	N	N	N	N	N	Y	N	N	HTN, DM,CAD,TB	Y	N	N	Y	Y	N	N	Y	N	N	N	N
50	538049	ck	F	55	164	60	22.31	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,CAD,PUL.DIS	Y	N	N	N	Y	N	N	N	Y	N	Y	N
51	538404	r	F	65	167	63	22.59	SOB,CP,SYNCOPE	N	N	N	Y	N	N	N	Y	N	Y	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N

-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	MRD	NAME	date of enrollment	BetaB	ace i	diuretics	EF	EF6	EF12	NYHA0	NYHA6	NYHA12	CREAT 0M	CREAT 6 MON	CREAT 12M	HBOM	HB6M	HB12M	TSH	BNP 0M	BNP6M	BNP12M	HAND GRIP	FRAILTY
1	94640	s	11.5.18	-	y	y	31	36	38	1	1	1	1.08	1.1	0.8	13.1	12.6	12.8	-	506	85	60	31	0
2	168301	m	12.5.18	y	y	y	37	36	38	2	2	2	0.8	1	0.9	14.8	14.2	13.6	-	126	72	70	23.5	1
3	162410	k	15.5.18	y	y	y	28	32	30	3	2	2	1.4	1.8	1.5	10.8	11.8	11.6	-	565	260	480	25.1	4
4	316540	p	15.5	y	y	y	20	24	22	3	3	3	1.07	1.21	1.15	12	11.7	11.9	2.7	856	690	721	12.9	4
5	37607	a	15.5	-	y	y	24	25	25	3	2	2	1	0.8	0.8	14.7	13.5	13.5	0.7	198	200	160	20.3	3
6	108453	v	16.5	-	y	y	25	30	34	3	2	2	1.1	1.1	1	11.2	12.1	12.1	-	320	108	100	20.8	-
7	109469	g	17.5	-	y	y	40	40	40	1	1	1	1	1.2	1	13.2	13.6	13.8	1.66	84	64	80	17	1
8	246958	d	17.5	-	y	y	25	30	30	2	2	2	0.8	0.8	0.8	12.1	11.6	11.2	-	234	120	200	26.2	3
9	67772	isha	17.5	y	y	y	30	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-	18.8	-
10	229418	h	22.5	y	y	y	35	40	40	1	1	1	0.9	0.9	0.9	14.8	13.7	13.6	2.8	354	200	60	24	0
11	155563	mk	22.5	-	y	y	36	36	40	2	2	2	0.5	0.8	0.5	13.4	12.7	13.5	-	150	-	72	74	1
12	159541	s	29.5	y	y	y	40	35	40	2	3	2	1	1	0.7	12.2	9.3	11.4	4.9	184	457	104	18	3
13	157018	k	29.5	y	y	y	35	35	35	2	2	2	1.2	1.7	1.3	11.9	10.9	11	-	3030	330	250	29.5	-
14	161360	ds	29.5	y	y	y	35	35	35	3	2	2	1.3	1.1	1.3	9.5	10	10	-	104	100	80	18.3	-
15	161141	s	29.5	y	y	y	32	35	35	2	2	2	1.2	1	1.1	11.1	11.2	10.8	-	110	84	76	15.6	4
16	161144	j	31.5	y	y	y	28	30	30	2	2	2	1	0.9	0.8	13.2	12.8	12.4	-	334	215	180	28.2	4
17	158597	a	31.5	y	y	y	32	35	35	2	2	2	1.2	0.8	0.8	11.5	12	11.8	-	82	98	100	20.8	2
18	158396	s	31.5	-	y	y	38	35	35	2	2	2	0.9	0.9	1.1	13.8	14	14.4	-	160	84	80	19.5	2
19	144588	u	31.5	-	y	y	42	40	40	2	2	2	0.7	0.8	1	11.7	11.3	11	-	61	68	100	23.6	2
20	515543	tara sing	31.5	-	y	y	22	25	30	2	3	2	1.1	1.2	1.2	11.8	12.2	12	2.36	100	80	64	34	-
21	159890	g	31.5	y	y	y	40	40	40	2	2	2	0.8	0.7	0.8	13.5	12.6	12.4	-	84	80	60	33.3	0
22	152413	k	1.6.18	-	y	y	25	30	30	2	2	2	1.2	1.1	1.2	11.6	12	11.8	-	80	60	90	10.8	1
23	148081	m	4.6	-	y	y	26	25	-	-	-	-	0.98	1.32	-	11.3	-	-	-	1400	-	-	16.1	3
24	99689	k	5.6	y	y	y	35	40	40	1	1	1	1.2	1.3	1.2	14.1	14	14	-	60	80	90	32.5	0
25	168273	j	5.6	-	y	y	26	25	25	2	2	2	0.7	0.9	0.8	13.2	12.6	12.8	-	450	300	180	28.9	4
26	116212	p	5.6	y	y	y	32	35	35	1	1	1	0.8	0.9	1	14.3	14	13.6	-	120	80	74	32.5	1
27	160939	k	5.6	-	y	y	40	35	35	2	2	2	0.8	1.1	1	13.7	12.9	12.6	-	360	240	250	26.6	3
28	161471	s	5.6	y	y	-	20	20	20	3	3	3	1.5	1.2	1.5	10.6	10.4	10.4	-	800	600	550	15.4	-
29	163456	a	12.6	y	y	y	30	36	36	2	2	2	1	1.6	1.4	14	13.8	13.6	-	432	230	180	29	-
30	166889	s	12.6	-	y	y	35	35	35	2	2	2	0.8	0.8	0.8	13.6	13.4	13	-	120	67	100	17.7	1
31	153156	a	14.6	y	y	y	34	35	35	2	3	3	1.1	0.9	1	15.9	13.2	13.6	-	430	260	180	16.3	3
32	96914	r	14.6	y	y	y	30	35	35	2	2	2	0.8	0.9	0.8	14	13.6	14	-	80	120	100	32.7	1
33	165877	s	14.6	y	y	y	35	35	35	2	2	2	1.6	1.5	1.4	12	11.6	11.8	2.19	118	72	84	16.7	1
34	156946	k	14.6	y	y	-	28	30	30	2	2	2	0.9	0.8	0.9	11.1	11.8	12.1	-	230	400	146	17.06	2
35	66375	j	15.6	y	y	y	28	30	30	2	2	2	4	4.6	4	13.2	13.6	13	-	424	380	360	33.4	3
36	31115	b	19.6	-	y	y	30	30	30	2	2	2	0.9	1	1.1	13.8	13.6	13.4	-	642	240	160	21.4	-
37	156139	r	19.6	-	y	y	36	35	35	3	2	2	0.9	0.9	0.8	13.4	13.2	13.4	-	5	60	84	31.3	3
38	165825	b	26.6	y	y	y	32	30	30	2	2	2	1.3	1.2	1.2	12.5	11.6	11	-	225	274	162	24.1	4
39	146880	j	26.6	y	y	y	30	32	30	2	3	3	1.75	2.3	2	9.8	9.8	10	-	416	222	162	31.2	-
40	335452	mk	26.6	-	y	y	22	25	25	2	2	2	0.7	0.9	1	11.8	11.2	11	-	1290	305	108	29.8	1
41	420609	h	26.6	-	y	y	28	30	30	2	2	2	1	0.9	0.9	13.7	13.2	13.8	-	22	60	42	32.4	1
42	524184	j	26.6	y	y	y	32	35	35	2	2	2	0.5	0.8	0.9	11.9	11.6	11.8	-	316	215	160	18.4	-
43	-	k	26.6	y	y	y	30	30	30	3	3	3	0.9	0.9	0.9	9.5	10	10.2	-	546	358	276	20.6	3
44	149483	r	28.6	-	y	y	30	30	30	2	2	2	1.6	1.7	1.6	11.8	11.4	11.6	-	418	216	244	21.1	2
45	527708	s	-	y	y	y	32	35	35	2	2	2	0.9	0.8	0.9	13.6	13.4	13	-	823	148	98	21.5	1
46	159890	g	4.7	y	y	y	32	35	35	3	2	2	0.6	0.8	0.9	12.6	12.8	12.8	-	416	230	114	35.3	-
47	529289	cr	4.7	-	y	y	25	25	25	2	3	2	0.79	0.9	0.8	16.2	15.8	15	-	649	550	216	27.8	3
48	496790	a	5.7	y	y	y	34	35	34	2	2	2	1.1	1.2	1.1	10.2	10.4	10.8	-	909	121	89	26.6	1
49	528382	p	6.7	-	y	y	28	30	-	3	3	-	1.57	1.8	-	8.4	8	-	-	684	570	-	5.1	3
50	538049	ck	17.7.18	-	y	y	35	35	38	-	-	-	0.56	0.8	0.8	13.2	12	12.6	6.08	327	238	-	10.8	2
51	538404	r	19.7.18	y	-	y	38	35	35	-	-	-	0.6	0.7	-	11.1	-	-	-	358	1680	-	14.8	2

-	-	-	-	-	-	-	-	-
-	**MRD**	**NAME**	**HOSPITALISATION 3 MONTHS**	**6 m HOSPI**	**12 m HOSPIT**	**3m MORT**	**6 M MORT**	**12 M MORT**
1	94640	s	-	-	-	-	-	-
2	168301	m	-	-	-	-	-	-
3	162410	k	-	-	Y	-	-	-
4	316540	p	-	Y	-	-	-	-
5	37607	a	-	-	-	-	-	-
6	108453	v	-	-	-	-	-	-
7	109469	g	-	-	-	-	-	-
8	246958	d	-	-	-	-	-	-
9	67772	isha	-	-	-	-	-	-
10	229418	h	-	-	-	-	-	-
11	155563	mk	-	-	-	-	-	-
12	159541	s	-	Y	-	-	-	-
13	157018	k	-	-	-	-	-	-
14	161360	ds	-	-	-	-	-	-
15	161141	s	-	-	-	-	-	-
16	161144	j	-	-	-	-	-	-
17	158597	a	-	-	-	-	-	-
18	158396	s	-	-	-	-	-	-
19	144588	u	-	-	-	-	-	-
20	515543	**tara sing**	-	-	-	-	-	-
21	159890	g	-	-	-	-	-	-
22	152413	k	-	-	-	-	-	-
23	148081	m	-	-	-	-	Y	-
24	99689	k	-	-	-	-	-	-
25	168273	j	-	-	-	-	-	-
26	116212	p	-	-	-	-	-	-
27	160939	k	-	-	-	-	-	-
28	161471	s	-	-	-	-	-	-
29	163456	a	-	-	-	-	-	-
30	166889	s	-	-	-	-	-	-
31	153156	a	-	-	-	-	-	-
32	96914	r	-	-	-	-	-	-
33	165877	s	-	-	-	-	-	-
34	156946	k	-	Y	-	-	-	-
35	66375	j	-	-	-	-	-	-
36	31115	b	-	-	-	-	-	-
37	156139	r	Y	-	-	-	-	-
38	165825	b	-	-	-	-	-	-
39	146880	j	-	-	-	-	-	-
40	335452	mk	-	-	-	-	-	-
41	420609	h	-	-	-	-	-	-
42	524184	j	-	-	-	-	-	-
43	-	k	-	-	-	-	-	-
44	149483	r	-	-	-	-	-	-
45	527708	s	-	-	-	-	-	-
46	159890	g	-	-	-	-	-	-
47	529289	cr	-	Y	-	-	-	-
48	496790	a	-	-	-	-	-	-
49	528382	p	-	-	-	-	Y	-
50	538049	ck	-	-	-	-	-	-
51	538404	r	-	-	-	-	-	-

-	-	-	-	-	-	-	-	-	COMPLAINTS										-	PART HISTORY												
-	MRD	NAME	SEX	AGE	HEIGHT	WEIGHT	BMI(Kg/m)	COMPLAINTS	ABD	ANOREX	OSA	CP	PAL	NO	SL	SOB	RECENT	SYNCOPE	PAST HISTORY	CAD	CAD (DCMP	CLD	DM	HTN	BA	CRD	TB	DIS	THYROID	PULDIS	OTHER
52	221329	jr	F	77	164	60	22.31	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD,PUL.DIS	Y	N	N	Y	Y	N	N	N	Y	N	Y	N
53	540024	r	F	57	164	76	28.26	CP	N	N	N	Y	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
54	172663	s	m	74	170	68	23.53	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
55	264607	m	F	80	160	59	23.05	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
56	210605	j	M	56	168	67	23.74	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
57	537762	h	m	56	169	70	24.51	SOB,PAL	N	N	N	N	Y	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
58	540117	p	F	62	163	65	24.46	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
59	540961	r	F	60	166	79	28.67	CP	N	N	N	Y	N	N	N	N	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N
-	264607	m	f	80	160	59	23.05	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
60	540614	s	F	78	161	63	24.30	CP,PAL	N	N	N	Y	Y	N	N	N	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
61	264512	h	F	64	165	70	25.71	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
62	471681	lakhram	M	76	170	65	22.49	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,DM,CAD(PTCA)	Y	N	N	Y	Y	N	N	N	N	N	N	N
63	540863	i	F	41	166	68	24.68	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
64	509800	m	f	40	165	76	27.92	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
65	521129	**k**	**M**	**70**	172	72	24.34	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
66	232023	r	M	50	170	65	22.49	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
67	45492	**pk**	**M**	**60**	165	81	29.75	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
68	464966	r	M	63	174	70	23.12	SOB,ABD	Y	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
69	525463	**rk**	**M**	**70**	171	65	22.23	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
70	221360	**sr**	**f**	**68**	162	68	25.91	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
71	546482	j	**M**	80	168	70	24.80	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
72	543909	rs	**M**	67	171	65	22.23	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,CP	N	N	N	N	Y	N	N	N	N	N	N	N
73	502589	s	**M**	55	173	78	26.06	CP	N	N	N	Y	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
74	380156	n	**M**	58	168	72	25.51	CP	N	N	N	Y	N	N	N	N	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
75	543659	h	**M**	71	170	64	22.15	CP	N	N	N	Y	N	N	N	N	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
76	546500	v	**M**	63	174	67	22.13	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
77	551624	m	**F**	50	163	65	24.46	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
78	539573	p	**M**	49	171	75	25.65	NO	N	N	N	N	N	Y	N	N	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
79	550800	r	**M**	32	168	72	25.51	SOB,ABD	Y	N	N	N	N	N	N	Y	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
80	145767	v	**M**	57	168	69	24.45	SOB	N	N	N	N	N	N	N	Y	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
81	155563	m	**F**	50	165	76	27.92	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD,PUL.DIS	Y	N	N	N	Y	N	N	N	Y	N	Y	N
82	517791	sk	**F**	60	167	71	25.46	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
83	555630	dl	**M**	60	172	67	22.65	SOB	N	N	N	N	N	N	N	Y	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
84	558362	lakhram	**M**	61	171	72	24.62	PAL	N	N	N	N	Y	N	N	N	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N
85	73788	m	**M**	74	170	69	23.88	SOB	N	N	N	N	N	N	N	Y	N	N	CAD(DCMP)	Y	Y	N	N	N	N	N	N	N	N	N	N
86	560952	p	**M**	64	173	65	21.72	CP	N	N	N	Y	N	N	N	N	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
87	560814	g	**M**	32	173	80	26.73	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N
88	560790	ts	**M**	55	168	70	24.80	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
89	512618	s	**M**	52	170	69	23.88	ANOREX	N	Y	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
90	564337	sk	**M**	58	171	70	23.94	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
91	177389	p	**M**	80	170	64	22.15	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CRD	N	N	N	Y	Y	N	Y	N	N	N	N	N
92	566938	b	**F**	60	162	75	28.58	SOB	N	N	N	N	N	N	N	Y	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N
93	524843	k	**F**	46	166	71	25.77	CP	N	N	N	Y	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
94	566770	c	M	70	171	65	22.23	CP,PAL	N	N	N	Y	Y	N	N	N	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
95	568340	zs	M	52	168	67	23.74	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
96	562560	p	F	51	165	68	24.98	SOB,SYNCOPE	N	N	N	N	N	N	N	Y	N	Y	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
97	160127	j	M	69	170	70	24.22	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
98	178418	s	F	70	162	65	24.77	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
99	168348	d	M	66	172	66	22.31	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
100	488054	b	F	45	166	67	24.31	SOB,SYNCOPE	N	N	N	N	N	N	N	Y	N	Y	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
101	469407	g	M	62	169	72	25.21	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N

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-	MRD	NAME	date of enrollment	BetaB	ace i	diuretics	EF	EF6	EF12	NYHA0	NYHA6	NYHA12	CREAT 0M	CREAT 6 MON	CREAT 12M	HBOM	HB6M	HB12M	TSH	BNP 0M	BNP6M	BNP12M	HAND GRIP	FRAILTY
52	221329	jr	20.7.18	-	y	y	30	-	-	3	-	-	1.08	-	-	9.3	-	-	-	1680	-	-	10.1	4
53	540024	r	19.7.18	y	-	y	36	35	35	3	2	2	0.5	0.6	0.6	11	10	10.8	-	35	28	46	13.6	2
54	172663	s	19.7.18	-	-	y	30	-	-	-	-	-	2.1	2.9	-	9.7	10.2	-	2.7	636	1050	-	10.2	4
55	264607	m	19.7.18	y	y	y	38	-	-	-	-	-	0.6	0.9	-	14.6	-	-	118	-	-	-	10.2	4
56	210605	j	19.7.18	-	y	y	26	30	30	2	2	2	0.9	0.8	0.8	15.3	14.6	15.1	-	320	260	150	26.3	2
57	537762	h	19.7.18	y	y	y	25	25	30	2	2	2	0.6	0.8	0.8	10.6	11.2	10.8	-	466	400	250	22.3	2
58	540117	p	19.7.18	-	y	y	35	38	38	2	2	2	0.8	0.9	0.8	13.2	13	12.8	-	1720	666	400	17.9	2
59	540961	r	20.7.18	-	-	-	35	26	-	2	3	-	0.6	0.7	-	13.9	13	-	-	1028	1084	-	13.3	3
-	264607	m	20.7	y	y	y	38	-	-	-	-	-	0.6	0.7	-	14	-	-	-	118	-	-	9.3	3
60	540614	s	20.7.18	-	-	y	36	36	38	2	2	2	1.4	1.5	1.6	10.5	11.2	11	-	117	108	100	18.1	3
61	264512	h	20.7.18	-	-	-	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.5	3
62	471681	lakhram	20.7.18	-	y	y	35	35	36	2	3	2	0.9	0.8	0.8	13.1	12.8	13.1	-	842	540	280	14.2	4
63	540863	i	20.7.18	-	y	y	26	-	-	-	-	-	0.8	0.9	-	9.9	-	-	-	1024	-	-	12.7	4
64	509800	m	20.7.18	-	y	y	30	35	35	2	2	2	0.6	0.6	0.8	9.9	10.6	10.8	-	418	188	106	9.2	4
65	521129	**k**	19.7.18	-	-	-	25	-	-	-	-	-	0.7	0.9	-	11.8	-	-	3.6	340	-	-	11.9	2
66	232023	r	23.7.18	-	y	y	30	38	38	2	2	2	0.74	0.7	0.8	14.2	14.2	14.1	-	640	200	160	27.33	2
67	45492	**pk**	22.7	-	-	-	30	35	35	2	2	2	0.8	0.8	0.8	14.1	12.9	13	-	256	80	60	14.8	3
68	464966	r	23.7	y	y	y	36	38	38	2	2	2	1.3	1.4	1.2	11.4	11.8	12	-	384	212	60	31.5	2
69	525463	**rk**	26.7.18	y	y	y	30	36	38	2	2	2	1.7	1.4	1.2	11.6	12.2	12	-	443	150	34	23.3	1
70	221360	**sr**	27.7	-	-	-	45	-	-	-	-	-	1.4	1.5	-	9.5	-	-	-	1000	-	-	13.8	4
71	546482	j	27.7	y	-	y	30	30	-	2	3	-	5.6	6.5	-	8.4	8	7.5	-	2840	1200	-	15.7	3
72	543909	rs	27.7	-	-	y	38	35	40	2	2	2	1.1	1.2	1	13.4	13.2	13	-	39	32	36	26.8	4
73	502589	s	26.7	y	-	y	26	30	30	2	2	2	0.9	0.96	0.8	14.4	14.7	14.2	-	5	87	38	34.3	3
74	380156	n	26.7	y	-	y	36	38	38	2	2	2	0.9	0.8	0.8	15.2	14.6	14.8	-	146	100	80	27.5	2
75	543659	h	26.7	y	-	y	35	35	35	2	2	2	1.6	1.5	0.9	12.5	12.8	13.2	-	325	150	100	31.7	4
76	546500	v	2.8.18	y	y	y	30	35	35	3	3	3	0.8	0.8	0.9	13	13.6	14	-	308	100	60	14	3
77	551624	m	3.8.18	-	y	y	36	35	35	3	2	2	0.6	0.8	0.8	12.1	12	12.4	-	1680	140	120	12.1	2
78	539573	p	3.8.18	y	-	y	30	35	35	2	2	2	0.6	0.9	0.8	12.3	12.3	12.4	-	-	234	104	29	2
79	550800	r	3.8	y	y	y	18	20	20	2	2	2	0.8	0.8	0.8	14.6	14.1	13.6	-	1540	700	360	24.1	2
80	145767	v	3.8	y	y	y	35	36	38	3	2	2	0.8	0.9	0.8	12.9	12.8	13.2	-	310	100	35	24.7	2
81	155563	m	9.8	-	y	y	35	38	36	2	2	2	0.46	0.5	0.6	12.7	13.5	13.4	-	250	80	60	20.6	2
82	517791	sk	9.8	y	y	-	32	34	35	3	3	3	8.84	9.5	8.4	8	8	8.2	-	3850	1304	1640	13.6	3
83	555630	dl	9.9	-	y	y	32	36	38	3	2	2	1.2	1.1	1	12.7	12.4	12.8	-	224	126	60	26.1	2
84	558362	lakhram	16.8	-	y	y	30	35	35	2	2	2	0.7	0.8	0.8	16.6	15.8	16	-	312	105	84	18.2	3
85	73788	m	16.9	-	y	y	28	32	34	3	2	2	1.1	1.3	1.2	10.6	11.6	11.6	-	1330	480	200	31.9	2
86	560952	p	16.9	y	y	y	30	32	36	2	2	2	0.7	0.79	0.8	11	10	10.8	-	156	70	64	17.9	2
87	560814	g	16.8	-	y	y	32	-	-	3	-	-	1.1	2.77	-	13.3	11.3	-	-	1100	-	-	28.1	4
88	560790	ts	16.8	-	y	y	20	20	20	3	3	3	1.1	0.7	0.8	11.6	9.9	10.8	-	1740	500	324	34.6	1
89	512618	s	16.8	-	y	y	26	30	30	3	2	2	0.9	0.9	0.8	13.1	13	12.4	-	793	314	84	23.9	2
90	564337	sk	24.8	y	y	y	28	30	35	2	2	2	1	1	0.8	13.3	13.2	12.8	-	537	101	64	29.7	2
91	177389	p	24.8	-	-	y	30	30	35	2	2	2	4.6	4.65	4.5	9.8	9.3	8.6	-	3770	844	334	18.4	4
92	566938	b	24.8	-	y	y	22	30	30	3	2	2	1.1	0.86	0.8	10.9	11	11.4	-	1790	514	200	23.9	2
93	524843	k	24.8	y	y	y	38	40	40	2	2	2	0.7	0.7	0.9	14.1	13.4	13.6	-	345	100	85	24.3	1
94	566770	c	24.8	y	y	y	30	35	35	2	2	2	0.9	0.98	0.8	16.4	14	14.3	-	221	72	64	33.7	1
95	568340	zs	29.8	-	-	y	28	30	30	3	2	2	0.9	0.83	1	14.8	15.1	15	-	1600	236	160	27.4	2
96	562560	p	29.8	-	y	y	30	30	30	3	2	2	1.5	1.2	1.5	12.8	11.8	11.6	-	1200	335	275	14.5	4
97	160127	j	29.8	-	y	y	30	30	30	2	2	2	1.2	0.9	1	10.9	11	10.8	-	30	89	168	24.6	1
98	178418	s	29.8	-	y	y	25	25	-	3	3	-	2.4	2.6	-	13.1	11	-	-	1160	1100	-	12.2	3
99	168348	d	6.9.18	y	y	y	20	20	20	3	3	3	0.8	0.8	0.8	10.7	11	10.6	-	725	1450	807	23.3	4
100	488054	b	6.9	y	y	y	36	35	35	3	3	3	0.5	0.7	0.8	10.5	10.6	10.8	-	227	146	260	14.1	3
101	469407	g	7.9	y	y	y	27	30	30	3	2	2	0.85	0.8	0.8	13.1	13.6	13.8	-	72	105	82	23.1	2

-	-	-	-	-	-	-	-	-
-	**MRD**	**NAME**	**HOSPITALISATION 3 MONTHS**	**6 m HOSPI**	**12 m HOSPIT**	**3m MORT**	**6 M MORT**	**12 M MORT**
52	221329	jr	-	-	-	Y	-	-
53	540024	r	-	-	-	-	-	-
54	172663	s	-	-	-	Y	-	-
55	264607	m	-	-	-	Y	-	-
56	210605	j	-	-	-	-	-	-
57	537762	h	-	-	-	-	-	-
58	540117	p	-	-	-	-	-	-
59	540961	r	-	-	-	-	Y	-
-	264607	m	-	-	-	-	-	-
60	540614	s	-	-	-	-	-	-
61	264512	h	-	-	-	-	-	-
62	471681	lakhram	-	Y	-	-	-	-
63	540863	i	-	-	-	-	Y	-
64	509800	m	-	-	-	-	-	-
65	521129	**k**	-	-	-	-	-	-
66	232023	r	-	-	-	-	-	-
67	45492	**pk**	-	-	-	-	-	-
68	464966	r	-	-	-	-	-	-
69	525463	**rk**	-	-	-	-	-	-
70	221360	**sr**	-	-	-	-	-	Y
71	546482	j	-	-	-	-	-	Y
72	543909	rs	Y	-	-	-	-	-
73	502589	s	Y	-	-	-	-	-
74	380156	n	-	-	-	-	-	-
75	543659	h	-	-	-	-	-	-
76	546500	v	-	-	-	-	-	-
77	551624	m	-	-	-	-	-	-
78	539573	p	-	-	-	-	-	-
79	550800	r	-	-	-	-	-	-
80	145767	v	-	-	-	-	-	-
81	155563	m	-	-	-	-	-	-
82	517791	sk	-	-	-	-	-	-
83	555630	dl	-	-	-	-	-	-
84	558362	lakhram	-	-	-	-	-	-
85	73788	m	-	Y	-	-	-	-
86	560952	p	Y	-	-	-	-	-
87	560814	g	-	-	-	-	Y	-
88	560790	ts	Y	-	-	-	-	-
89	512618	s	-	-	-	-	-	-
90	564337	sk	-	-	-	-	-	-
91	177389	p	Y	-	-	-	-	-
92	566938	b	-	-	-	-	-	-
93	524843	k	-	-	-	-	-	-
94	566770	c	-	-	-	-	-	-
95	568340	zs	-	-	-	-	-	-
96	562560	p	-	-	-	-	-	-
97	160127	j	-	-	-	-	-	-
98	178418	s	-	Y	-	-	Y	-
99	168348	d	-	-	-	-	-	-
100	488054	b	-	-	-	-	-	-
101	469407	g	-	-	-	-	-	-

-	-	-	-	-	-	-	-	-	COMPLAINTS										-	PART HISTORY												
-	MRD	NAME	SEX	AGE	HEIGHT	WEIGHT	BMI(Kg/m)	COMPLAINTS	ABD	ANOREX	OSA	CP	PAL	NO	SL	SOB	RECENT	SYNCOPE	PAST HISTORY	CAD	CAD (DCMP	CLD	DM	HTN	BA	CRD	TB	DIS	THYROID	PULDIS	OTHER
102	403233	r	F	35	165	70	25.71	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
103	190642	d	M	63	168	70	24.80	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
104	243664	r	F	56	160	63	24.61	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
105	576665	rj	M	60	172	69	23.32	CP,ABD	Y	N	N	Y	N	N	N	N	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N	N
106	577126	p	F	75	162	64	24.39	SOB,PAL,SYNCOF	N	N	N	N	Y	N	N	Y	N	Y	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N	N
107	162567	c	M	85	170	65	22.49	SOB,ABD	Y	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
108	578037	d	M	58	172	65	21.97	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N	N
109	459349	s	M	64	174	73	24.11	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N	N
110	577940	k	F	44	164	68	25.28	SOB,PAL	N	N	N	N	Y	N	N	Y	N	N	NO	N	N	N	N	N	N	N	N	N	N	N	N	N
111	441214	r	M	52	174	80	26.42	SOB,SL	N	N	N	N	N	N	Y	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
112	268211	k	F	49	163	60	22.58	SOB,PAL,ABD	Y	N	N	N	Y	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
113	184425	s	M	74	170	70	24.22	ABD	Y	N	N	N	N	N	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
114	311326	s	M	46	168	71	25.16	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
115	415865	f	M	70	169	68	23.81	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
116	536973	p	M	53	166	69	25.04	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
117	178488	b	M	58	165	68	24.98	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
118	167448	ag	M	56	172	74	25.01	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N	N
119	585977	bs	M	58	168	67	23.74	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
120	310029	n	F	70	161	58	22.38	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
121	504639	ak	F	58	166	73	26.49	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
122	570043	ns	M	70	167	63	22.59	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N	N
123	594285	bn	F	65	162	67	25.53	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD,THYROID DIS,OT	Y	N	N	N	Y	N	N	N	Y	Y	N	Y
124	595115	h	M	58	173	70	23.39	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,DM,CRD,CAD	Y	N	N	Y	Y	N	Y	N	N	N	N	N	N
125	146880	jp	M	66	168	64	22.68	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
126	580803	mk	F	45	162	66	25.15	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
127	366103	b	M	30	173	72	24.06	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
128	148644	r	M	66	170	64	22.15	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CRD,CAD	Y	N	N	Y	N	N	Y	N	N	N	N	N	N
129	424911	r	F	64	162	72	27.43	SYNCOPE	N	N	N	N	N	N	N	N	N	Y	CAD,BA	Y	N	N	N	N	Y	N	N	N	N	N	N	N
130	527708	s	M	61	167	68	24.38	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N
131	570317	rd	M	56	168	68	24.09	SOB,SYNCOPE	N	N	N	N	N	N	N	Y	N	Y	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
132	247283	ck	F	65	164	68	25.28	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
133	271583	bk	F	64	157	62	25.15	NO	N	N	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N	N
134	158608	d	F	69	164	56	20.82	N O	N	N	N	N	N	N	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
135	550800	n	M	32	168	72	25.51	NO	N	N	N	N	N	Y	N	N	N	N	CAD,PUL.DIS ,THYROID DI	Y	N	N	N	N	N	N	N	Y	Y	Y	N
136	157198	v	F	55	162	66	25.15	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
137	576463	us	F	60	160	68	26.56	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
138	547492	ak	M	34	172	68	22.99	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N	N
139	405200	r	M	64	170	63	21.80	SOB,ABD,OSA	Y	N	Y	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
140	158450	kl	F	72	159	55	21.76	SOB, PAL	N	N	N	N	Y	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
141	149483	rk	M	72	171	60	20.52	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N
142	540863	i	F	42	166	68	24.68	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N
143	120540	js	M	70	158	56	22.43	SOB,CP,ANOREX	N	Y	N	Y	N	Y	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N	N
144	531982	g	M	55	171	72	24.62	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
145	597525	p	F	42	166	74	26.85	SOB,PAL,SL	N	N	N	N	Y	N	Y	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
146	591341	ur	F	64	150	61	27.11	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N	N
147	425231	p	F	60	162	60	22.86	SOB,CP,	N	N	N	Y	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
148	237697	k	M	55	170	69	23.88	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
149	148473	j	M	51	173	71	23.72	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
150	586101	v	M	50	174	72	23.78	CP	N	N	N	Y	N	N	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N	N
151	507605	a	M	48	165	72	26.45	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N
152	26836	km	F	70	158	62	24.84	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N	N

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-	MRD	NAME	date of enrollment	BetaB	ace i	diuretics	EF	EF6	EF12	NYHA0	NYHA6	NYHA12	CREAT 0M	CREAT 6 MON	CREAT 12M	HBOM	HB6M	HB12M	TSH	BNP 0M	BNP6M	BNP12M	HAND GRIP	FRAILTY
102	403233	r	7.9	y	y	y	35	35	35	3	2	2	0.7	0.7	0.8	14.2	13.6	13.8	-	188	67	94	24.4	2
103	190642	d	7.9	y	y	y	20	20	20	2	3	3	1	1	0.8	15.9	14.6	14	-	1470	560	467	36.6	4
104	243664	r	8.9	y	y	y	22	25	25	2	2	2	0.6	0.6	0.8	12.5	12	11.8	-	78	104	98	25.1	2
105	576665	rj	8.9	-	y	y	35	35	35	2	2	2	0.9	0.9	0.9	15.8	15.2	15	-	64	85	59	22.7	1
106	577126	p	8.9	y	y	y	30	30	30	3	3	3	1.3	1.5	1.4	13.2	12.8	12.2	-	901	337	279	13.8	4
107	162567	c	10.9	-	y	y	35	35	35	2	2	2	1.2	1.4	1.5	11.6	11	11.4	-	268	170	256	30.4	3
108	578037	d	10.9	-	y	y	36	35	35	2	2	2	0.8	0.8	0.8	16	15.4	14.8	-	36	68	108	32.5	1
109	459349	s	10.9	-	-	y	28	25	-	2	3	-	9.6	10.2	-	8.4	8.5	-	-	680	1100	-	11.6	3
110	577940	k	10.9	-	y	y	22	25	25	2	2	2	1.3	1.4	1.4	11.2	11	11.4	-	1570	321	100	29.1	1
111	441214	r	10.9	-	y	y	36	40	40	2	2	2	0.9	0.9	0.9	11.5	11.8	11.6	-	65	76	55	42.7	0
112	268211	k	10.9	y	y	y	30	30	30	2	2	2	0.7	0.9	0.8	13.1	12.8	12.4	-	105	76	88	18.7	1
113	184425	s	10.9	y	y	y	20	25	25	2	2	2	0.7	0.9	0.9	13.4	13.8	13	-	127	48	84	21.7	1
114	311326	s	12.9	y	y	y	30	30	30	3	2	2	0.9	0.6	0.9	10.2	10.4	11	-	57	97	68	18.9	1
115	415865	f	17.6	-	y	y	32	30	30	2	2	2	2	1.2	1.6	14.6	12.4	11.9	-	108	305	97	18	2
116	536973	p	11.7	-	y	y	30	30	30	3	2	2	0.7	0.7	0.8	12.5	13.4	13.8	-	40	84	72	21.2	2
117	178488	b	5.10.18	-	-	y	25	25	25	2	3	2	0.93	0.9	1.2	8.9	10.2	10.6	-	698	188	121	17.9	3
118	167448	ag	5.10.18	-	y	y	25	25	25	2	2	2	1.6	1.7	1.5	10.9	11.2	11.6	-	380	68	75	15.9	3
119	585977	bs	5.1	-	y	y	16	16	20	3	3	3	0.8	0.8	1.2	13	13.2	11.8	-	476	360	368	20	4
120	310029	n	5.1	y	y	y	23	25	25	2	2	2	0.8	0.8	0.8	12	12.7	10.6	-	279	181	221	13.3	4
121	504639	ak	5.10.18	-	y	y	24	25	25	3	2	3	0.9	1.16	1.3	10.4	10.2	10.4	-	722	148	94	21.7	3
122	570043	ns	7.10.18	y	y	y	35	35	35	3	3	2	1.7	1.8	1.5	11	10.8	11.1	-	348	284	212	26.6	4
123	594285	bn	8.10.18	-	y	y	20	25	25	3	2	2	1.1	1.2	1.4	12.2	13.4	13.6	-	1180	108	60	24.4	1
124	595115	h	8.10.18	-	-	y	20	-	-	-	-	-	1.7	-	-	11.9	-	-	-	2650	-	-	16.7	3
125	146880	jp	10.10.18	-	-	y	38	35	35	1	2	2	2.2	3.32	2.8	8.9	9.4	9.5	-	1184	475	380	29.7	1
126	580803	mk	10.1	-	-	y	20	20	20	3	2	2	1.6	1.8	1.5	12	11.8	11.5	-	380	107	171	8.6	2
127	366103	b	10.1	y	y	y	20.4	25	25	3	2	2	1.2	1.6	1.1	11.3	11.6	11.8	-	101	65	74	36.7	0
128	148644	r	11.10.18	-	y	y	28	30	30	3	2	2	1.4	1.8	1.6	8.8	10.7	10.5	-	249	164	200	24	1
129	424911	r	11.10.18	-	-	-	38	35	35	2	2	2	0.7	0.7	0.9	11.8	10.8	11.4	-	1680	571	228	14.9	3
130	527708	s	12.1	y	y	y	32	-	-	-	-	-	0.9	0.79	-	10.9	10.8	-	-	300	-	-	23.8	2
131	570317	rd	22.1	y	y	y	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	1
132	247283	ck	30.1	-	y	y	20	-	-	-	-	-	0.8	0.8	-	12.8	-	-	-	-	-	-	14.7	2
133	271583	bk	7.9	y	y	-	34	35	34	3	2	2	0.9	0.9	0.9	12	12.6	12.8	-	381	68	108	17.9	1
134	158608	d	7.9	-	y	y	35	35	35	3	2	2	1.7	1.6	1.5	9.4	10.6	10	-	414	238	211	16.8	1
135	550800	n	27.9	-	y	y	18	20	25	2	2	2	0.8	0.7	0.8	14.2	14	13.6	-	518	284	191	25.9	1
136	157198	v	20.9	y	y	y	25	30	30	2	2	2	1.13	1.1	0.9	11.5	11.6	11.8	-	350	103	56	12.1	2
137	576463	us	20.9	y	y	y	36	35	35	2	2	2	1.4	1.5	1.4	10.8	11	10.6	-	412	244	180	18.7	3
138	547492	ak	14.9	y	y	y	25	25	30	2	2	2	0.6	0.7	0.8	14.2	14	14.1	-	274	69	101	34.8	1
139	405200	r	14.9	y	y	y	30	35	35	3	2	2	0.8	0.8	0.8	13.1	13.6	13.8	-	218	60	58	34.2	1
140	158450	kl	19.9	y	y	y	22	25	25	3	3	2	1.08	1	0.9	11.2	11.4	11.8	-	445	216	171	14.4	2
141	149483	rk	19.9	-	y	y	30	-	-	-	-	-	1.6	1.7	-	12	-	-	-	-	-	-	21.1	2
142	540863	i	19.9	-	y	y	30	30	-	3	3	-	0.9	0.9	-	10.2	11	-	-	1100	800	-	12	3
143	120540	js	8.10.18	y	y	y	36	35	35	3	2	2	1.3	1.4	1	11.4	11.8	12	-	134	80	68	16.7	1
144	531982	g	8.10.	y	y	y	32	35	35	2	2	2	1	0.9	0.8	11.9	12	11.8	-	202	58	101	30.1	1
145	597525	p	8.10.	y	y	y	36	38	38	2	2	2	0.9	0.7	0.6	12.6	12.4	12.2	-	428	64	80	17.9	1
146	591341	ur	2.10.	-	y	y	25	25	25	3	3	3	0.8	0.8	0.7	12.5	12.8	12.8	-	426	122	98	8.9	3
147	425231	p	8.10.	y	y	y	30	35	35	2	2	2	0.8	0.9	1	11.8	11.4	11	-	320	211	160	29.2	1
148	237697	k	15.10.	y	y	y	32	35	35	3	2	2	1	0.8	1	13.5	13.4	13	5.9	1020	120	128	27	1
149	148473	j	17.10.	-	y	y	30	30	30	2	2	2	0.5	0.5	0.7	13.6	13	13.4	-	100	60	74	28.9	1
150	586101	v	17.10.	y	y	y	30	35	35	3	2	2	0.8	0.8	0.8	16.4	15.8	16	-	101	48	65	34.4	1
151	507605	a	15.10.	y	y	y	25	30	30	3	2	2	1.4	1.5	1.5	15.1	14.8	15	-	593	276	84	16.5	1
152	26836	km	20.10.	-	y	y	35	35	35	3	3	3	0.6	0.8	0.7	12.2	11.8	11.6	-	7	64	160	12	3

-	-	-	-	-	-	-	-	-
-	MRD	NAME	HOSPITALISATION 3 MONTHS	6 m HOSPI	12 m HOSPIT	3m MORT	6 M MORT	12 M MORT
102	403233	r	-	-	-	-	-	-
103	190642	d	Y	-	-	-	-	-
104	243664	r	-	-	-	-	-	-
105	576665	rj	-	-	-	-	-	-
106	577126	p	-	-	-	-	-	-
107	162567	c	-	-	-	-	-	-
108	578037	d	-	-	-	-	-	-
109	459349	s	-	-	-	-	Y	-
110	577940	k	-	-	-	-	-	-
111	441214	r	-	-	-	-	-	-
112	268211	k	-	-	-	-	-	-
113	184425	s	-	-	-	-	-	-
114	311326	s	-	-	-	-	-	-
115	415865	f	Y	-	-	-	-	-
116	536973	p	Y	-	-	-	-	-
117	178488	b	-	-	-	-	-	-
118	167448	ag	-	-	-	-	-	-
119	585977	bs	-	-	-	-	-	-
120	310029	n	-	-	-	-	-	-
121	504639	ak	-	-	-	-	-	-
122	570043	ns	Y	-	-	-	-	-
123	594285	bn	-	-	-	-	-	-
124	595115	h	-	-	-	Y	-	-
125	146880	jp	-	Y	-	-	-	-
126	580803	mk	-	-	-	-	-	-
127	366103	b	-	-	-	-	-	-
128	148644	r	-	-	-	-	-	-
129	424911	r	Y	-	-	-	-	-
130	527708	s	-	-	-	-	-	-
131	570317	rd	-	-	-	-	-	-
132	247283	ck	-	-	-	-	-	-
133	271583	bk	-	-	-	-	-	-
134	158608	d	-	-	-	-	-	-
135	550800	n	-	-	-	-	-	-
136	157198	v	-	-	-	-	-	-
137	576463	us	-	-	-	-	-	-
138	547492	ak	-	-	-	-	-	-
139	405200	r	-	-	-	-	-	-
140	158450	kl	-	-	-	-	-	-
141	149483	rk	-	-	-	-	-	-
142	540863	i	-	-	-	-	Y	-
143	120540	js	-	-	-	-	-	-
144	531982	g	-	-	-	-	-	-
145	597525	p	-	-	-	-	-	-
146	591341	ur	-	-	-	-	-	-
147	425231	p	-	-	-	-	-	-
148	237697	k	-	-	-	-	-	-
149	148473	j	-	-	-	-	-	-
150	586101	v	-	-	-	-	-	-
151	507605	a	-	-	-	-	-	-
152	26836	km	-	-	-	-	-	-

-	-	-	-	-	-	-	-	-	COMPLAINTS										-	PART HISTORY											
-	MRD	NAME	SEX	AGE	HEIGHT	WEIGHT	BMI(Kg/m)	COMPLAINTS	ABD	ANOREX	OSA	CP	PAL	NO	SL	SOB	RECENT	SYNCOPE	PAST HISTORY	CAD	CAD (DCMP	CLD	DM	HTN	BA	CRD	TB	DIS	THYROID	PULDIS	OTHER
153	540723	bk	F	64	165	67	24.61	RECENT	N	N	N	N	N	N	N	N	Y	N	HTN,DM,CAD,OTHER	Y	N	N	Y	Y	N	N	N	N	N	N	N
154	225384	r	F	64	152	66	28.57	SOB,CP, RECENT	N	N	N	Y	N	N	N	Y	Y	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
155	421269	rk	M	40	170	72	24.91	OSA	N	N	Y	N	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
156	42370	t	M	67	174	69	22.79	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD,PUL.DIS	Y	N	N	Y	Y	N	N	N	Y	N	Y	N
157	148945	s	M	53	165	70	25.71	ANOREX	N	Y	N	N	N	Y	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
158	215278	sk	F	60	160	58	22.66	SOB,ANOREX	N	Y	N	N	N	Y	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
159	152696	vs	M	69	171	67	22.91	SL	N	N	N	N	N	N	Y	N	N	N	HTN,DM,CAD,THYROID DI	Y	N	N	Y	Y	N	N	N	Y	Y	N	N
160	339683	nk	F	65	164	63	23.42	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
161	569243	ak	M	50	173	70	23.39	SOB	N	N	N	N	N	N	N	Y	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
162	492407	pd	F	67	163	68	25.59	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
163	490609	sg	M	58	176	68	21.95	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
164	491800	ks	M	70	174	69	22.79	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
165	415865	fc	M	65	169	68	23.81	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
166	347475	tc	M	82	172	66	22.31	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
167	159793	ac	M	70	176	66	21.31	SOB,PAL	N	N	N	N	Y	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
168	231750	ss	M	73	172	67	22.65	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
169	484441	rd	M	53	167	76	27.25	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
170	489113	v	F	76	168	65	23.03	CP	N	N	N	Y	N	N	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
171	186972	an	M	63	170	80	27.68	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
172	493725	nk	F	55	163	66	24.84	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD,PUL.DIS	Y	N	N	Y	N	N	N	N	Y	N	Y	N
173	498155	ns	M	70	160	70	27.34	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
174	501437	gs	M	57	175	70	22.86	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
175	496049	pk	M	67	173	72	24.06	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
176	492938	k	M	55	175	68	22.20	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
177	148644	r	M	65	170	64	22.15	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
178	491288	vj	M	48	174	67	22.13	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
179	180837	rs	M	65	172	70	23.66	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
180	493642	bk	M	72	172	68	22.99	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
181	420275	rm	M	78	171	68	23.26	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
182	195193	a	F	64	162	66	25.15	SOB	N	N	N	N	N	N	N	Y	N	N	HTN , CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
183	154884	bk	M	67	174	73	24.11	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
184	528382	pk	M	62	168	64	22.68	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
185	145765	s	M	66	171	71	24.28	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,PUL.DIS	N	N	N	N	Y	N	N	N	Y	N	Y	N
186	517207	bk	M	70	172	68	22.99	CP	N	N	N	Y	N	N	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
187	524801	js	M	38	175	74	24.16	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
188	247283	ck	F	65	164	68	25.28	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
189	155012	ak	F	79	162	58	22.10	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
190	425081	ts	M	80	170	65	22.49	SOB,ANOREX	N	Y	N	N	N	Y	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
191	32934	kk	F	67	158	54	21.63	SOB,PAL	N	N	N	N	Y	N	N	Y	N	N	HTN,PUL.DIS	N	N	N	N	Y	N	N	N	Y	N	Y	N
192	319622	a	M	66	174	69	22.79	NO	N	N	N	N	N	Y	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
193	517791	sk	F	59	167	71	25.46	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
194	523241	hs	M	66	173	64	21.38	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
195	519498	va	M	60	170	72	24.91	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
196	148173	hk	F	64	159	60	23.73	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
197	509042	r	F	66	163	71	26.72	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
198	529887	js	M	41	175	74	24.16	SOB	N	N	N	N	N	N	N	Y	N	N	DM	N	N	N	Y	N	N	N	N	N	N	N	N
199	424911	rg	F	64	162	72	27.43	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
200	529840	k	M	52	169	65	22.76	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
201	279757	s	M	74	173	78	26.06	SOB,ANOREX	N	Y	N	N	N	Y	N	Y	N	N	HTN	N	N	N	N	Y	N	N	N	N	N	N	N
202	73732	hs	M	80	172	66	22.31	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
203	212218	bs	M	64	172	70	23.66	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N

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-	MRD	NAME	date of enrollment	BetaB	ace i	diuretics	EF	EF6	EF12	NYHA0	NYHA6	NYHA12	CREAT 0M	CREAT 6 MON	CREAT 12M	HBOM	HB6M	HB12M	TSH	BNP 0M	BNP6M	BNP12M	HAND GRIP	FRAILTY
153	540723	bk	2.10.	y	y	y	35	35	35	2	2	2	0.95	0.9	0.9	11.5	11.8	11.6	-	321	105	88	24.3	2
154	225384	r	2.1	y	-	y	35	35	35	3	3	3	3.4	4.6	5	9.3	8.8	8.6	-	1990	684	580	9.5	3
155	421269	rk	23.10.	y	y	-	36	38	36	2	2	2	0.7	0.8	0.9	13.9	12.8	12.4	-	260	80	60	33.9	2
156	42370	t	22.10.	-	y	y	32	30	30	3	3	3	1.3	1.5	1.2	11.6	11	11.4	-	370	128	180	19.6	3
157	148945	s	6.10.	y	y	-	38	40	40	2	2	2	1.47	1.4	1.5	14.9	14.6	14.8	-	314	244	78	25.6	2
158	215278	sk	6.10.	-	y	y	32	34	35	3	2	2	1.7	1.6	1.8	9.6	10.4	10.6	-	378	281	248	12.2	2
159	152696	vs	6.1	y	y	y	28	30	30	2	2	2	1.3	1.5	1.4	13.3	12.8	13	3.9	350	180	168	15.4	2
160	339683	nk	12.9	y	y	y	34	35	35	2	2	2	0.8	0.8	0.8	12	12.4	12.8	-	360	201	78	19.1	2
161	569243	ak	28.8	-	y	y	25	28	30	2	2	2	0.7	0.8	0.8	12.9	12.8	13	-	335	105	82	18.8	2
162	492407	pd	8.5	-	-	y	30	30	30	3	3	3	6	5.5	7	7.4	8.1	9.7	-	2490	1100	890	16.7	3
163	490609	sg	7.5	y	-	y	32	35	35	2	2	2	0.8	0.8	0.7	16.5	14.6	14.8	-	29	84	68	18.8	2
164	491800	ks	6.5	-	y	y	20	25	25	3	2	2	0.7	0.8	0.9	10.2	10.8	11	-	1030	105	80	20.6	1
165	415865	fc	3.5	-	-	y	25	28	30	2	2	2	1.6	1.5	1.5	12.4	12.8	13.1	-	479	119	120	14.7	2
166	347475	tc	29.5	y	y	y	35	35	35	3	3	3	1.29	1.14	1.4	12.6	11.9	11.8	-	429	316	280	15.8	4
167	159793	ac	16.5	-	-	y	25	25	-	3	4	-	1.59	1.7	-	10.9	8.2	-	-	984	776	-	18.9	4
168	231750	ss	14.5	-	y	y	24	25	-	3	3	-	1.5	1.6	-	14	14.2	-	-	737	800	-	17.8	4
169	484441	rd	10.5	-	y	y	32	35	35	3	3	3	0.69	0.8	0.8	12	11.5	11.8	2.48	412	100	212	20.9	3
170	489113	v	8.5	-	-	y	32	30	30	3	3	3	0.75	0.65	0.8	13.3	10.9	11.1	-	306	280	218	16.6	4
171	186972	an	2.5	-	-	y	34	-	-	-	-	-	6.9	-	-	7.8	-	-	-	2970	-	-	18.2	-
172	493725	nk	24.5	-	y	y	28	30	30	2	2	2	0.8	1	0.9	12.5	11.6	11.8	-	658	241	105	13.8	2
173	498155	ns	18.5	-	y	y	25	25	25	3	3	3	1.6	1.5	1.7	9.8	10.4	10	0.1	5000	1100	749	18.2	3
174	501437	gs	23.5	-	y	y	25	28	30	3	2	2	0.8	0.7	0.8	11.6	11	11.4	-	1130	106	53	25.8	2
175	496049	pk	17.5	-	-	y	25	25	-	3	3	-	0.9	0.7	-	11.9	11	-	-	507	700	-	28	4
176	492938	k	12.5	-	y	y	22	25	25	3	2	2	0.6	0.7	0.8	12.4	11.1	11.8	7.09	1470	234	78	17.8	2
177	148644	r	11.5	-	-	y	28	30	30	2	2	2	1.6	2.1	1.8	10.2	10	10.6	-	2030	748	246	19.1	3
178	491288	vj	7.5	y	y	y	32	35	35	2	2	2	0.6	0.8	0.8	11.9	11.1	11	-	67	104	88	21	2
179	180837	rs	16.5	-	y	y	28	-	-	-	-	-	0.73	0.54	-	11.3	9.3	-	-	789	-	-	16.3	3
180	493642	bk	11.5	-	-	y	38	36	38	2	2	2	2.2	1.6	2	9.4	9.8	10.6	-	360	70	104	17.5	1
181	420275	rm	17.5	-	-	y	27	30	28	2	2	2	2.2	1.8	2.4	9.9	8.4	9.5	-	3320	560	349	16.8	2
182	195193	a	1.6	-	y	y	28	25	25	3	3	3	1	1	0.9	13.9	14	13.6	-	1100	411	320	20.8	4
183	154884	bk	29.6	-	-	y	20	25	25	3	2	2	1.3	1.23	1.3	12.5	11.6	11.8	-	1730	108	120	18.4	2
184	528382	pk	6.7	y	-	y	28	-	-	-	-	-	1.57	0.92	-	8.4	8.3	-	-	-	-	-	19.5	3
185	145765	s	18.6	-	-	y	35	35	35	2	2	2	1.7	1.6	1.8	14.1	13.8	14	-	506	172	211	15.7	3
186	517207	bk	20.6	-	-	y	28	-	-	-	-	-	1.4	-	-	12.5	-	-	-	1950	-	-	17.3	4
187	524801	js	26.6	y	y	y	18	20	20	3	2	2	1.2	1.1	0.9	13.2	14.1	14	-	1000	100	180	26.4	2
188	247283	ck	16.6	-	y	y	20	25	25	3	2	2	0.8	0.8	0.9	12.8	12	12.4	-	1120	278	126	18.3	2
189	155012	ak	17.6	-	-	y	37	35	40	3	2	2	0.8	0.6	0.8	10.7	11.9	11.4	-	709	267	111	15.8	2
190	425081	ts	17.6	-	y	y	25	25	25	3	3	3	1.3	1.1	1.4	10.9	10.3	10.6	-	4530	528	256	16,8	3
191	32934	kk	13.6	-	y	y	40	40	40	2	2	2	1.2	1.1	1.2	10.6	10	10.7	-	700	216	118	23.6	2
192	319622	a	18.6	y	-	y	35	35	35	2	3	3	2	2.4	2.1	10.2	9.2	10.8	-	1340	800	618	17.3	3
193	517791	sk	11.6	y	-	y	30	-	-	-	-	-	5.9	10.78	-	8.2	8.4	-	-	-	-	-	16.4	1
194	523241	hs	20.6	-	y	y	32	-	-	-	-	-	1.4	1	-	12	10.6	-	-	849	-	-	18.2	1
195	519498	va	19.6	-	y	y	30	-	-	-	-	-	1.1	0.7	0.6	14.1	13.8	-	-	-	-	-	17.8	4
196	148173	hk	12.6	-	-	y	22	-	-	-	-	-	1.2	0.8	-	10	10.4	-	-	496	-	-	15.6	3
197	509042	r	29.5	-	y	y	26	-	-	-	-	-	0.6	1.5	-	10.6	10.7	-	-	1330	-	-	16	3
198	529887	js	11.7	-	y	y	25	28	28	2	2	2	0.74	0.8	0.8	12.8	13	12.6	-	627	68	104	19	1
199	424911	rg	9.7	y	y	y	35	-	-	-	-	-	0.9	0.76	0.71	11.7	11.8	-	-	1680	-	-	16.6	3
200	529840	k	1.7	-	y	y	18	-	-	-	-	-	1.4	1.29	1.07	13.9	12.7	-	-	1190	-	-	15.8	2
201	279757	s	6.7	y	y	y	35	35	35	3	2	2	0.8	0.83	0.7	10.6	10	10.8	-	447	234	200	16.7	3
202	73732	hs	3.7	-	-	y	30	-	-	3	-	-	1.2	-	-	12.2	-	-	-	997	-	-	14.6	3
203	212218	bs	22.7	-	y	y	35	35	35	2	2	2	1.1	1.2	1	13.1	12.8	13.4	-	966	160	85	17.7	2

-	-	-	-	-	-	-	-	-
-	MRD	NAME	HOSPITALISATION 3 MONTHS	6 m HOSPI	12 m HOSPIT	3m MORT	6 M MORT	12 M MORT
153	540723	bk	-	-	-	-	-	-
154	225384	r	-	-	-	-	-	-
155	421269	rk	-	-	-	-	-	-
156	42370	t	-	-	-	-	-	-
157	148945	s	-	-	-	-	-	-
158	215278	sk	-	-	-	-	-	-
159	152696	vs	-	-	-	-	-	-
160	339683	nk	-	-	-	-	-	-
161	569243	ak	-	-	-	-	-	-
162	492407	pd	-	-	-	-	-	-
163	490609	sg	-	-	-	-	-	-
164	491800	ks	-	-	-	-	-	-
165	415865	fc	-	-	-	-	-	-
166	347475	tc	-	-	-	-	-	-
167	159793	ac	-	-	-	-	Y	-
168	231750	ss	-	-	-	-	Y	-
169	484441	rd	-	-	-	-	-	-
170	489113	v	-	-	-	-	-	-
171	186972	an	-	-	-	y	-	-
172	493725	nk	-	-	-	-	-	-
173	498155	ns	-	-	-	-	-	-
174	501437	gs	-	-	-	-	-	-
175	496049	pk	-	-	-	-	Y	-
176	492938	k	-	-	-	-	-	-
177	148644	r	-	-	-	-	-	-
178	491288	vj	-	-	-	-	-	-
179	180837	rs	-	-	-	-	-	-
180	493642	bk	-	-	-	-	-	-
181	420275	rm	-	-	-	-	-	-
182	195193	a	-	-	-	-	-	-
183	154884	bk	-	-	-	-	-	-
184	528382	pk	-	-	-	Y	-	-
185	145765	s	-	-	-	-	-	-
186	517207	bk	-	-	-	Y	-	-
187	524801	js	-	-	-	-	-	-
188	247283	ck	-	-	-	-	-	-
189	155012	ak	-	-	-	-	-	-
190	425081	ts	-	-	-	-	-	-
191	32934	kk	-	-	-	-	-	-
192	319622	a	-	Y	-	-	-	-
193	517791	sk	-	-	-	-	-	-
194	523241	hs	-	-	-	-	-	-
195	519498	va	Y	-	-	-	-	-
196	148173	hk	-	-	-	-	-	-
197	509042	r	-	-	-	-	-	-
198	529887	js	-	-	-	-	-	-
199	424911	rg	Y	-	-	-	-	-
200	529840	k	-	-	-	-	-	-
201	279757	s	-	-	-	-	-	-
202	73732	hs	-	-	-	Y	-	-
203	212218	bs	-	-	-	-	-	-

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-	MRD	NAME	SEX	AGE	HEIGHT	WEIGHT	BMI(Kg/m)	COMPLAINTS	ABD	ANOREX	OSA	CP	PAL	NO	SL	SOB	RECENT	SYNCOPE	PAST HISTORY	CAD	CAD (DCMP	CLD	DM	HTN	BA	CRD	TB	DIS	THYROID	PULDIS	OTHER
204	538049	ck	F	55	164	60	22.31	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,CAD,PUL.DIS	Y	N	N	N	Y	N	N	N	Y	N	Y	N
205	169834	jk	F	61	156	63	25.89	NO	N	N	N	N	N	Y	N	N	N	N	DM,CRD,THYROID DIS	N	N	N	Y	N	N	Y	N	Y	Y	N	N
206	533749	gl	M	50	170	74	25.61	SOB	N	N	N	N	N	N	N	Y	N	N	CRD,CAD,PUL.DIS	Y	N	N	N	N	N	Y	N	Y	N	Y	N
207	525576	k	F	52	166	71	25.77	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
208	448989	rs	M	49	174	67	22.13	NO	N	N	N	N	N	Y	N	N	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
209	288932	bd	F	86	160	56	21.88	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM	N	N	N	Y	Y	N	N	N	N	N	N	N
210	548800	ps	M	61	174	68	22.46	SOB,CP	N	N	N	Y	N	N	N	Y	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
211	529887	js	M	41	175	74	24.16	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
212	179542	rp	M	56	171	78	26.67	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
213	529824	at	M	70	172	70	23.66	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CRD,CAD	Y	N	N	Y	Y	N	Y	N	N	N	N	N
214	553065	bs	M	46	170	76	26.30	SOB	N	N	N	N	N	N	N	Y	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
215	522777	j	M	45	172	64	21.63	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
216	35178	jr	M	77	169	71	24.86	NO	N	N	N	N	N	Y	N	N	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
217	529887	js	M	41	175	74	24.16	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
218	307136	gs	M	56	171	69	23.60	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD,PUL.DIS	Y	N	N	Y	Y	N	N	N	Y	N	Y	N
219	145767	vs	M	57	168	69	24.45	SOB	N	N	N	N	N	N	N	Y	N	N	DM,CAD	Y	N	N	Y	N	N	N	N	N	N	N	N
220	283121	pk	M	55	172	65	21.97	CP	N	N	N	Y	N	N	N	N	N	N	HTN,CAD	Y	N	N	N	Y	N	N	N	N	N	N	N
221	325625	s	M	91	170	62	21.45	SOB	N	N	N	N	N	N	N	Y	N	N	CAD,PUL.DIS	Y	N	N	N	N	N	N	N	Y	N	Y	N
222	160127	js	M	69	170	70	24.22	SOB	N	N	N	N	N	N	N	Y	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
223	557835	kl	F	65	165	69	25.34	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CAD	Y	N	N	Y	Y	N	N	N	N	N	N	N
224	177389	ps	M	79	170	64	22.15	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
225	566087	mr	M	64	170	67	23.18	CP	N	N	N	Y	N	N	N	N	N	N	HTN,DM,CRD,CAD	Y	N	N	Y	Y	N	Y	N	N	N	N	N
226	168189	sk	F	56	160	64	25.00	NO	N	N	N	N	N	Y	N	N	N	N	CAD	Y	N	N	N	N	N	N	N	N	N	N	N
227	486106	jk	F	59	164	68	25.28	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N
228	176610	ys	M	71	172	72	24.34	-	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N

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-	MRD	NAME	date of enrollment	BetaB	ace i	diuretics	EF	EF6	EF12	NYHA0	NYHA6	NYHA12	CREAT 0M	CREAT 6 MON	CREAT 12M	HBOM	HB6M	HB12M	TSH	BNP 0M	BNP6M	BNP12M	HAND GRIP	FRAILTY
204	538049	ck	13,7	-	y	y	25	28	30	3	2	2	0.9	0.9	0.7	12.8	13.2	13.1	-	513	216	102	15.9	2
205	169834	jk	6.7	-	-	y	30	30	30	3	3	3	5.7	6	6.1	6.1	7	6.8	-	1030	630	448	17.8	3
206	533749	gl	6.7	-	-	y	20	25	25	3	2	2	1.6	1.4	1	14.6	14	13.6	-	700	318	225	15.1	4
207	525576	k	24.6	y	y	y	20	22	22	3	3	3	1.3	0.9	1.1	12.2	12.6	11.8	-	1040	426	321	16.9	3
208	448989	rs	19.6	y	y	-	22	25	28	2	2	2	0.7	0.8	0.8	14.6	14.5	-	-	300	105	80	20.6	1
209	288932	bd	21.6	-	-	y	36	35	35	3	3	3	1.3	1.5	1.4	8.4	9.1	8.8	-	375	244	180	16.1	3
210	548800	ps	28.7	-	y	y	25	28	28	2	2	2	1.56	1.1	1.4	10.9	11	10.8	-	1610	105	70	17.3	1
211	529887	js	20.8	-	-	-	25	-	-	-	-	-	1.4	0.8	-	12.8	12.1	-	-	627	-	-	20.8	2
212	179542	rp	20.8	-	-	y	30	30	30	3	3	3	3.31	3.8	3.4	11.5	10.2	11	-	1320	400	354	21.6	3
213	529824	at	24.8	-	-	y	28	-	-	-	-	-	2.6	-	-	11.9	-	-	-	-	-	-	17.5	3
214	553065	bs	3.8	y	y	y	26	30	30	3	2	2	1	0.8	0.7	14.7	13.9	14.4	1.21	328	180	208	21.5	3
215	522777	j	19.6	-	-	y	30	-	-	3	-	-	2.2	-	-	11.2	-	-	-	550	-	-	22.6	3
216	35178	jr	21.6	-	y	y	35	35	35	3	3	3	1.4	1.5	1.4	14.6	13.3	13	3.94	847	275	201	17.4	3
217	529887	js	20.7	-	-	-	25	-	-	-	-	-	1.4	0.8	-	12.8	12.1	-	-	627	-	-	22.8	-
218	307136	gs	30.7	-	y	y	33	35	35	2	2	2	0.5	0.9	0.8	14	13.6	14	-	287	105	111	18.4	2
219	145767	vs	1.8	-	-	-	35	35	35	2	2	2	0.8	1.1	1	12	12.6	12.4	-	513	160	88	20.3	2
220	283121	pk	23.8	-	y	y	25	25	25	3	3	3	0.9	0.9	1	11.9	12.1	11.8	-	507	180	160	18.3	3
221	325625	s	18.8	-	-	y	37	-	-	3	-	-	1.2	-	-	9.6	-	-	-	781	-	-	13.8	3
222	160127	js	28.8	-	y	y	35	35	35	3	2	2	1.2	1.1	1	10.9	11.4	11	-	30	105	72	28.4	2
223	557835	kl	10.8	-	y	y	40	40	40	2	2	2	1.2	1	1.1	9.6	10	10.2	-	537	231	84	17.8	3
224	177389	ps	20.8	-	-	y	30	30	30	3	3	3	4.6	4.1	3.8	9.8	10	10.1	-	2410	880	664	14.8	3
225	566087	mr	22.8	y	-	y	40	-	-	3	-	-	6.4	-	-	10.7	-	-	-	696	-	-	17.2	3
226	168189	sk	30.9	-	-	y	22	22	25	3	2	2	1	0.7	0.9	12	12.4	12.6	-	3650	121	100	16.7	2
227	486106	jk	24.8	y	y	-	30	-	-	-	-	-	0.6	0.8	-	13.8	13	-	10.3		-	-	19.5	1
228	176610	ys	4.6	y	-	y	28	-	-	-	-	-	1	1	-	13	13.4	-	-	1090	-	-	17.8	3

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-	**MRD**	**NAME**	**HOSPITALISATION 3 MONTHS**	**6 m HOSPI**	**12 m HOSPIT**	**3m MORT**	**6 M MORT**	**12 M MORT**
204	538049	ck	-	-	-	-	-	-
205	169834	jk	-	-	-	-	-	-
206	533749	gl	-	Y	-	-	-	-
207	525576	k	-	Y	-	-	-	-
208	448989	rs	-	-	-	-	-	-
209	288932	bd	-	-	-	-	-	-
210	548800	ps	-	-	-	-	-	-
211	529887	js	-	-	-	-	-	-
212	179542	rp	-	-	-	-	-	-
213	529824	at	-	-	-	Y	-	-
214	553065	bs	Y	-	-	-	-	-
215	522777	j	-	-	-	Y	-	-
216	35178	jr	-	-	-	-	-	-
217	529887	js	-	-	-	-	-	-
218	307136	gs	Y	-	-	-	-	-
219	145767	vs	-	-	-	-	-	-
220	283121	pk	-	-	-	-	-	-
221	325625	s	-	-	-	Y	-	-
222	160127	js	-	-	-	-	-	-
223	557835	kl	-	-	-	-	-	-
224	177389	ps	-	-	-	-	-	-
225	566087	mr	-	-	-	Y	-	-
226	168189	sk	-	-	-	-	-	-
227	486106	jk	-	-	-	-	-	-
228	176610	ys	-	-	-	-	-	-

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Date 5/9/18

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 31.08.2018 has approved the plan of thesis of Neelesh Chandra Pandey, a student of your college for DM Cardiology along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis

Assessment of handgrip strength as a predictor of prognosis in patients of congestive heart failure

Supervisor
Dr. Bishav Mohan
Prof.,
Dept. of Cardiology,
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The student has to submit the four copies of thesis, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CONGESTIVE HEART FAILURE

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DM

IN

CARDIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

February, 2018

DR. NEELESH CHANDRA PANDEY

DEPARTMENT OF CARDIOLOGY
DAYANAND MEDICAL COLLEGE & HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CONGESTIVE HEART FAILURE
For the degree of	DM Cardiology
Name of the candidate	Dr Neelesh Chandra Pandey
Supervisor	Dr Bishav Mohan, Professor Department of Cardiology.
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Introduction: Congestive heart failure (CHF) is a leading cause of hospitalization and death and has a major adverse impact on patient health status, including symptoms, functional incapacity, impaired health-related quality of life (HRQOL), and mortality. Handgrip strength has shown prognostic utility in the assessment of a number of healthy aging and chronic disease outcomes in older adults. Specifically, studies have supported associations of grip strength with frailty, physical activity, diabetes, functional limitations, nutritional status, metabolic syndrome, and mortality. Grip strength may be important to examine in all adults given its relation with overall muscular strength and fitness.

Aim of study: 1. To assess the role of handgrip strength as a predictor of prognosis in patients of CHF.

2. To assess the correlation between progression in cardiac functions and handgrip strength with duration of heart failure.

Materials and methods: the study will include adult male and female patients of CHF arriving in the OPD of HDHI inclusion in the study will be subject to prior informed and written consent by the patients handgrip strength of the patients will be measured by a standardised dynamometer.

Clinical significance: Utility of grip strength as an indicator of prognosis in patients of CHF.

Keywords: Handgrip, CHF, Prognosis.

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CONGESTIVE HEART FAILURE"** exist in the Department of Cardiology, Dayanand Medical College&Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate herself under our supervision and guidance.

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APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE AND HOSPITAL, LUDHIANA

Name of Candidate	Dr Neelesh Chandra Pandey
Department	Cardiology
Topic of Thesis	**ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CONGESTIVE HEART FAILURE**
Likely date of appearing in PG exam	May 2020
Date of enrolment	21 October 2017
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Signatures of Members of Research Committee with Stamp	**Signatures of Members of Ethical Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HODSPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HODObst. &Gynae
	8. Legal Expert
	9. Secretary, IEC
	10. Dean Academics
	11.Vice Principal
	12 Principal

Approved: Yes/No

Chairperson,
Research Committee
Chairperson
Research Committee

Approved: Yes/No

Chairperson,
Ethics Committee
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR NEELESH CHANDRA PANDEY SA 15/144 D-18, CHANDRA HERITAGE, SARNATH , VARANASI
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL , LUDHIANA
3	COURSE OF STUDY AND SUBJECT	DM CARDIOLOGY
4	DATE OF ADMISSION OF COURSE	21 October 2017
5	TITLE OF THE TOPIC	ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF HEART FAILURE

6.0 BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Congestive heart failure (CHF) is a leading cause of hospitalization and death and has a major adverse impact on patient health status, including symptoms, functional incapacity, impaired health-related quality of life (HRQOL), and mortality.[1-4]

Physical activity and physical fitness are also widely known to be inversely related to mortality due disease in general.[5] Several reports suggest a relation between mortality in patients with CHF and physiologic outcomes such as peak oxygen uptake (V_O2), traditionally used to predict patient prognosis and to select patients for cardiac transplantation.

The magnitude of the alteration in functional performance seems to be related to the underlying etiology of cardiac disease: individuals with heart failure report greater impairment in walking and daily activities than do patients with angina or acute myocardial infarction.[6] In addition, CHF is a growing public health problem, mainly because of an aging population and the increased prevalence of CHF in the elderly.[7]

Many elderly patients with CHF may try to avoid or may not complete cardiopulmonary exercise testing (CPX) to measure peak V_O2 and D VO2=D WR. Thus, it is necessary to discover other measures that could also be used for the physical assessment of CHF patients.

Handgrip strength has shown prognostic utility in the assessment of a number of healthy aging and chronic disease outcomes in older adults. Specifically, studies have supported associations of grip strength with frailty, physical activity, diabetes, functional limitations, nutritional status, metabolic syndrome

and mortality.[8,9] Grip strength may be important to examine in all adults given its relation with overall muscular strength and fitness. When performed in standing position , grip strength also captures lower body and core muscle strength used in balance of exertion and force. By contrast grip strength performed in a seated position targets relatively smaller muscle groups and is more localised to the upper body.

In patients with coronary heart disease, handgrip strength decreases with age, is lower in women, and provides valuable information as an integrated predictor of physical function in older patients with cardiac disease.

Decline in muscle mass and quality are associated with ageing but more studies are needed to assess the utility of grip strength as an indicator of muscle strength in chronic cardiovascular diseases such as CHF.

6.2 REVIEW OF LITERATURE

Previous research in older adults has shown that grip strength is associated with physiologic and clinical cardiovascular biomarkers. A study of adults aged 59–73 years showed that grip strength was associated with individual markers and summary definitions of metabolic syndrome.[10-13] This study and others document a link between impaired muscle strength and cardiovascular disease risk factors in older adults; however, few studies have examined this in a general adult population. One recent study of more than 139,000 adults aged 35–79 years supported grip strength as a prognostic tool for all-cause death, cardiovascular death, and cardiovascular disease but did not include U.S. adults. In participants aged 15–69 years, one study12 showed equivocal patterns in mean differences across grip strength normative categories and a number of cardiovascular health indicators. These studies [15-17] indicate that one difficulty with understanding the associations between grip strength and cardiovascular health is the confounding of body size. Relative grip strength (absolute strength corrected for a measure of body size such as BMI) has been recommended to address both the confounding of strength by body mass and concomitant health risks of increased body weight and low muscular strength.[18] Relative grip strength is comparable to laboratory based approaches [19] and may increase the translational value of grip strength as a prognostic tool.

Relative grip strength may be a feasible measure to use in future muscle strength and body composition research given it is relatively simple, quick, reliable, and inexpensive to use. More research in the general population may

be needed to disentangle the relations among body size; muscular strength function, and quality; and meaningful cardiovascular health outcomes.

Frailty has been identified as an important prognostic marker in various patient cohorts including the elderly, subclinical cardiovascular disease, coronary artery disease and patients undergoing cardiac surgery. Frailty has also been proposed as an additional marker of patient outcomes in patients undergoing destination therapy VAD implantation but in whom definitive prospective data are lacking. Handgrip strength (HGS) is a marker of frailty and is included in several frailty scoring systems.[20-23] HGS correlates highly with the strength of elbow flexion, knee extension, and trunk extension and its use to approximate overall muscle function avoids many of the pitfalls of testing larger muscle groups particularly in advanced HF patients with minimal tolerance of physical exertion and in hospitalized, deconditioned patients.21 HGS has been shown to independently predict adverse health outcomes and mortality in diverse populations.

Hulsmann et al.[24] suggested that knee flexor muscle strength is very important in association with mortality in CHF patients. Isokinetic strength of the knee flexor muscles in their patients was related to mortality and was important in the context of other exercise measures such as peak V_{O2} and work load. Maintenance of muscle strength throughout life reduces functional limitations that might closely relate to early death, especially in the elderly.[21] Traditionally, handgrip strength has been a good indicator of overall muscle strength and predictor of mortality in middle-aged and elderly people and other ill patients.[21,25] It is also a powerful predictor of cause-specific and total mortality in older disabled women.[20] In patients with coronary heart disease,

handgrip strength decreases with age, is lower in women, and provides valuable information as an integrated predictor of physical function in older patients with cardiac disease. Increased handgrip strength is also associated with increased HRQOL in patients with CHD.[26] Loss of physical function in CHF patients contributes to difficulties in the performance of both leisure time and daily activities, which use the upper extremities as much or more than the lower extremities.

Handgrip strength alone was found by multivariate analysis to be a predictor of mortality in patients with CHF. Several reasons were hypothesized for this. Major alterations in skeletal muscle ultrastructure and biochemistry occur in patients with CHF, who have reduced muscle mass and decreased type I (oxidative) muscle fibers, capillary density, and oxidative enzymatic activity, and an increased percentage of type II fibers, mainly as a result of an increase in type II b fibers. The percentage of each type of fiber comprising different muscles is not similar. The knee flexor muscles are mainly composed of type I fiber antigravity muscles, whereas knee extensor muscles are composed of type II fibers. These findings may indicate that the percentage of type I fibers is reduced as CHF severity increases. Thus, reduction in oxygen activity in type I fibers might be blunted primarily by an increase in the quantity of fibers, and only when disease severity increases is muscle strength also affected.

Peak oxygen uptake ($VO_{2\ peak}$) in patients with heart failure (HF) is inversely related to muscle sympathetic nerve activity (MSNA) at rest. It was hypothesized that the MSNA response to handgrip exercise is augmented in HF patients and is greatest in those with low $VO_{2\ peak}$. Sterns and co-workers

observed similar increases in MSNA which was expressed as the percent change in total amplitude) in response to static handgrip at 30% MVC in HF and control subjects. MSNA rose further during PHGI in controls but diminished in HF subjects. These authors concluded that the metaboreceptor reflex is impaired in HF.

Symptomatic heart failure due to left ventricular systolic dysfunction is characterized by limited exercise capacity, impaired peripheral vasodilation, and increases in central sympathetic outflow to hemodynamically important vascular beds. Plasma norepinephrine levels and cardiac norepinephrine spillover are increased in asymptomatic left ventricular dysfunction, are further increased in patients with severe heart failure (HF), and are associated with poor prognosis. In advanced HF, skeletal muscle metabolism is altered and blood flow to small and large muscle groups is reduced at rest and during dynamic exercise. Patients with the lowest $V_{O2\ peak}$ have the greatest impairment in blood flow. As a consequence, low levels of rhythmic handgrip exercise that are insufficient to elicit sympathetic excitation in healthy subjects might induce ischemia and trigger the muscle metaboreflex in patients with HF due to systolic dysfunction. Indeed, in experimental canine HF, the muscle metaboreflex is tonically active during moderate exercise, is stimulated at a lower threshold, and raises blood pressure primarily by means of reflex neurogenic vasoconstriction rather than through an increase in cardiac output. However, there is disagreement as to whether this reflex contributes to the increase in resting adrenergic tone in human HF or becomes active and functionally important during exercise.

O'Leary noted an increase in heart rate that was maintained in dogs given atropine during muscle ischemia after whole body exercise. Thus in the present study, decreased vagal tone in the HF group might unmask underlying sympathetically induced increases in heart rate. Consistent with this concept and in contrast to control subjects, the heart rate of HF patients remained elevated during posthandgrip ischemia (PHGI) after both isometric exercise and isotonic exercise at 50% MVC. This additional novel finding suggests that the muscle metaboreflex has an important role in determining the heart rate response to exercise in human HF.

6.3 AIMS AND OBJECTIVE

1. To assess the role of handgrip strength as a predictor of prognosis in patients of CHF.
2. To assess the correlation between progression in cardiac functions and handgrip strength with duration of heart failure.

7. MATERIAL AND METHODS

This is a prospective study for a period of 12 months to be conducted at department of Cardiology, Dayanand Medical College and Hospital, Ludhiana.

7.1 SOURCE OF DATA

The study will include adult male and female patients of CHF arriving in the OPD of HDHI

7.2 METHOD OF COLLECTION OF DATA

1. Inclusion in the study will be subject to prior informed and written consent by the patients.
2. Handgrip strength of the patients will be measured by a standardised Camry hand dynamometer.
3. Patient will be made to sit comfortably and allowed to hold the dynamometer after 10 minutes rest, with his/her dominant hand with arm at right angle to the floor. The dynamometer will be adjusted to allow the grip between the heel of the palm and the middle of four fingers. The patient will be asked to squeeze the dynamometer with his/her hand and forearm strength for 5 seconds. This will be repeated three times in dominant arm with a recovery phase of 15 seconds and the average of the score will be recorded.
4. Handgrip scores will be obtained at entry level in the study
5. Baseline echocardiography will be done at entry level of all the patients for assessing the cardiac functions.
6. Patients will be evaluated for the outcome in terms of rehospitalisation rate, mortality, stroke and NYHA class/ METs at the end of 3 months, 6 months and 12 months in the study.

Inclusion criteria

- Age > 40 years
- Patients with informed consent and willing for 12 months follow up

Exclusion criteria

- Patients with decompensated heart failure
- Patients with stroke or muscle wasting or myopathies or wasting disorders.
- Patients who are unable to provide informed consent
- Patients who are unable to use the handgrip dynamometer appropriately.
- Patients who cannot perform follow-up in the centre.

Duration of study

Study will be conducted for a period of 12 months.

Statistical Analysis

Categorical data are presented asdescriptive statistics. Data will be expressed as mean ± SD for age group and gender. Categorical variables will compared by chi-square analysis. Continuous variables will be compared by student t-test. Statistical significance will be defined as $p<0.05$.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

None

7.4 HAS ETHICAL CLEARENCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Yes, attached herewith.

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PROFORMA

Sr. No.

PARTICULARS OF THE PATIENT

PATIENT'S NAME:

AGE (YRS): GENDER: M/F

OCCUPATION:

MRD. NO.:

ADDRESS: Tel:

PRESENTING COMPLAINTS:

	YES / NO	Duration of illness
SHORTNESS OF BREATH (NYHA CLASS)		
CHEST PAIN		
PALPITATION		
SYNCOPE		
ANOREXIA,EARLY SATIETY		
SWELLING LEGS		
ABDOMINAL DISTENSION		
OBSTRUCTIVE SLEEP APNOEA HISTORY		
RECENT OR FREQUENT PRIOR HOSPITALIZATION		
ANY OTHER COMPLAINTS		

Signature of Candidate **Signature of Supervisor**

PAST HISTORY:

DISEASE	Y/N	DURATION IN MONTHS/YEARS
HYPERTENSION		
DIABETES		
RENAL FAILURE		
CARDIAC DISEASE		
PULMONARY DISEASE		
THYROID DISORDER		
TUBERCULOSIS		
BRONCHIAL ASTHMA		
OTHER		

PERSONAL HISTORY:

- ALCOHOL(amount/duration & alcohol equivalents):
- SMOKING:
- OTHER SUBSTANCE ABUSE(route of consumption & duration)
- Vegetarian / non vegetarian

EXAMINATION

Weight / height BMI(kg/m^2)

	AT ENROLLMENT	AT 3 MONTHS	AT 6 MONTHS	AT 1 YEAR
PULSE				
BP				
RESPIRATORY RATE				
TEMPERATURE				
PALLOR				
CYNOSIS				
EDEMA				
CLUBBING				
JUGULAR VENOUS PRESSURE				
LYMPHADENOPATHY				
ICTERUS				

OTHER FINDINGS

Signature of Candidate **Signature of Supervisor**

SYSTEMIC EXAMINATION

	AT ENROLLMENT	AT 3 MONTHS	AT 6 MONTHS	AT 1 YEAR
CVS				
APEX				
PARASTERNAL HEAVE				
HEART SOUNDS				
S3 OR GALLOP				
MURMUR -MR -AR				
APEX				
RESPIRATORY AIR ENTRY BREATH SOUNDS RHONCHI / CREPTS				
PER ABDOMEN				
CNS (muscle power in UL)				

Signature of Candidate **Signature of Supervisor**

OLD TREATMENT RECORD

MEDICATIONS

S. no	Drugs	Dose	Route of administration	Start and stop date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

WHETHER COMPLIANT TO TREATMENT YES/NO

IF NO, SINCE HOW MANY DAYS AND REASON

Signature of Candidate

Signature of Supervisor

INVESTIGATIONS

	AT ENROLLMENT	AT 3 MONTHS	AT 6 MONTHS	AT 1 YEAR
Hb				
TLC/DLC				
PLATELET				
RBS				
UREA				
CREATININE				
SODIUM/POTASSIUM/ CHLORIDE				
CALCIUM				
TOTAL BILIRUBIN				
DIRECT BILIRUBIN				
SGOT/SGPT				
TOTAL PROTEIN/ALBUMIN				
TSH				
CARDIAC BIOMARKERS:				
CPK-MB				
TROP-T				
BNP				

Signature of Candidate **Signature of Supervisor**

ASSESSMENT OF METS SCORE (on each specified visits):

	At enrollment	At 3 months	At 6 months	At 1 year
Activities with >7 METS : (NYHA 1)				
Strenuous sports (swimming, football , basketball etc)				
Activities with 5-7 METs : (NYHA 2)				
Climbing a flight of stairs				
Walking at a level ground with 4mph				
Running a short distance				
Heavy housework (scrubbing floors, moving furnitures)				
Moderate recreational activities (dancing, throwing a ball etc)				
Activities with approx. 2-5 METs: (NYHA 3)				
Self care				
Eating , dressing, or using the toilet				
Cooking , cleaning dishes, ironing				
Yoga				
Walking indoors and around the house				

Not able to perform any of the above activities - <2 METs (NYHA 4)

Signature of Candidate **Signature of Supervisor**

Parameter	At enrollment(date)
Handgrip strength (Age / sex)	
	Weak/ Normal / Strong

Parameter	At enrollment (date)	At 3 months (date)	At 6 months (date)	At 12 months (date)
NYHA class / METS score				
Ejection fraction PASP MR AR				
Mortality	---NA---			
Readmission rate	---NA---			
Stroke	---NA---			

Signature of Candidate

Signature of Supervisor

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... am willing to participate in the study **"ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CHF"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out of the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत नी/पुत्र/पुत्री _____ निवासी _____ इस शोधकार्य **"ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CHF"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद् देश्य स्पष्ट कर दिया गया है और मुझे यह विश वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

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गवाह के हस्ताक्षर

नाम:

रोगी के हस्ताक्षर/अंगूठे का निशान

नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫ਼ਾਰਮ

ਮਿਤੀ _____

ਮੈਂ _____ ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ _____

ਵਾਸੀ _____

"ASSESSMENT OF HANDGRIP STRENGTH AS A PREDICTOR OF PROGNOSIS IN PATIENTS OF CHF" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈਂ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈਂ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਤਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ _ ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

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ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ _____

ਪਤਾ _____

_____
ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ _____

ਪਤਾ _____

_____
ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____
ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ